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PARACHUTE RIGGER 3 & 2

BUREAU OF NAVAL PERSONNEL

NAVY TRAINING COURSE **NAVPERS 10358-B**

U.S.S.D.

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PREFACE

This Navy Training Course was prepared for enlisted personnel of both the Regular Navy and the Naval Reserve who are studying for advancement in the Parachute Rigger rating. As indicated by the title, the course is based on the professional qualifications for advancement to the rates of PR3 and PR2, as stated in the Manual of Qualifications for Advancement in Rating, NavPers 18068-A. A reading list, which includes other publications recommended as study material for all Parachute Rigger personnel, is provided in the front of the book.

This training course was prepared by the U. S. Navy Training Publications Center, Memphis, Tennessee, for the Bureau of Naval Personnel. Technical review of the manuscript was provided by personnel of the Parachute Rigger Schools, NATTU, Lakehurst, New Jersey, and the Bureau of Naval Weapons, Washington, D. C.

1964 Edition

U.S.S.D.

THE UNITED STATES NAVY

GUARDIAN OF OUR COUNTRY

The United States Navy is responsible for maintaining control of the sea and is a ready force on watch at home and overseas, capable of strong action to preserve the peace or of instant offensive action to win in war.

It is upon the maintenance of this control that our country's glorious future depends; the United States Navy exists to make it so.

WE SERVE WITH HONOR

Tradition, valor, and victory are the Navy's heritage from the past. To these may be added dedication, discipline, and vigilance as the watchwords of the present and the future.

At home or on distant stations we serve with pride, confident in the respect of our country, our shipmates, and our families.

Our responsibilities sober us; our adversities strengthen us.

Service to God and Country is our special privilege. We serve with honor.

THE FUTURE OF THE NAVY

The Navy will always employ new weapons, new techniques, and greater power to protect and defend the United States on the sea, under the sea, and in the air.

Now and in the future, control of the sea gives the United States her greatest advantage for the maintenance of peace and for victory in war.

Mobility, surprise, dispersal, and offensive power are the keynotes of the new Navy. The roots of the Navy lie in a strong belief in the future, in continued dedication to our tasks, and in reflection on our heritage from the past.

Never have our opportunities and our responsibilities been greater.

ACTIVE DUTY ADVANCEMENT REQUIREMENTS

<table>
<tr><th>REQUIREMENTS *</th><th>E1 to E2</th><th>E2 to E3</th><th>E3 to E4</th><th>E4 to E5</th><th>E5 to E6</th><th>E6 to E7</th><th>† E7 to E8</th><th>‡ E8 to E9</th></tr>
<tr><td>SERVICE</td><td>4 mos. service—or completion of recruit training.</td><td>6 mos. as E-2.</td><td>6 mos. as E-3.</td><td>12 mos. as E-4.</td><td>24 mos. as E-5.</td><td>36 mos. as E-6.</td><td rowspan="2">48 mos. as E-7. 8 of 11 years total service must be enlisted. Must be permanent appointment.</td><td rowspan="2">24 mos. as E-8. 10 of 13 years total service must be enlisted.</td></tr>
<tr><td>SCHOOL</td><td>Recruit Training.</td><td></td><td>Class A for PR3, DT3, PT3.
ǂ AME 3</td><td></td><td></td><td>Class B for AGCA, MUCA, MNCA.</td></tr>
<tr><td>PRACTICAL FACTORS</td><td>Locally prepared check-offs.</td><td colspan="7">Records of Practical Factors, NavPers 760, must be completed for E-3 and all PO advancements.</td></tr>
<tr><td>PERFORMANCE TEST</td><td></td><td></td><td colspan="4">Specified ratings must complete applicable performance tests before taking examinations.</td><td></td><td></td></tr>
<tr><td>ENLISTED PERFORMANCE EVALUATION</td><td colspan="2">As used by CO when approving advancement.</td><td colspan="6">Counts toward performance factor credit in advancement multiple.</td></tr>
<tr><td>EXAMINATIONS</td><td colspan="2">Locally prepared tests.</td><td colspan="4">Service-wide examinations required for all PO advancements.</td><td colspan="2">Service-wide, selection board, and physical.</td></tr>
<tr><td>NAVY TRAINING COURSE (INCLUDING MILITARY REQUIREMENTS)</td><td></td><td colspan="5">Required for E-3 and all PO advancements unless waived because of school completion, but need not be repeated if identical course has already been completed. See NavPers 10052 (current edition).</td><td colspan="2">Correspondence courses and recommended reading. See NavPers 10052 (current edition).</td></tr>
<tr><td rowspan="2">AUTHORIZATION</td><td colspan="2">Commanding Officer</td><td colspan="3">U.S. Naval Examining Center</td><td colspan="3">Bureau of Naval Personnel</td></tr>
<tr><td colspan="6">TARS are advanced to fill vacancies and must be approved by CNARESTRA.</td><td colspan="2"></td></tr>
</table>

* All advancements require commanding officer's recommendation.
† 2 years obligated service required.
‡ 3 years obligated service required.
ǂ Effective 1 Jan. 1963.

INACTIVE DUTY ADVANCEMENT REQUIREMENTS

REQUIREMENTS *		E1 to E2	E2 to E3	E3 to E4	E4 to E5	E5 to E6	E6 to E7	E8	E9
	FOR THESE DRILLS PER YEAR								
TOTAL TIME IN GRADE	48	6 mos.	6 mos.	15 mos.	18 mos.	24 mos.	36 mos.	48 mos.	24 mos.
	24	9 mos.	9 mos.	15 mos.	18 mos.	24 mos.	36 mos.	48 mos.	24 mos.
	NON-DRILLING	12 mos.	24 mos.	24 mos.	36 mos.	48 mos.	48 mos.		
DRILLS ATTENDED IN GRADE †	48	18	18	45	54	72	108	144	72
	24	16	16	27	32	42	64	85	32
TOTAL TRAINING DUTY IN GRADE †	48	14 days	14 days	14 days	14 days	28 days	42 days	56 days	28 days
	24	14 days	14 days	14 days	14 days	28 days	42 days	56 days	28 days
	NON-DRILLING	None	None	14 days	14 days	28 days	28 days		
PERFORMANCE TESTS				Specified ratings must complete applicable performance tests before taking examination.					
PRACTICAL FACTORS (INCLUDING MILITARY REQUIREMENTS)		Record of Practical Factors, NavPers 760, must be completed for all advancements.							
NAVY TRAINING COURSE (INCLUDING MILITARY REQUIREMENTS)		Completion of applicable course or courses must be entered in service record.							
EXAMINATION		Standard exams are used where available, otherwise locally prepared exams are used.						Standard EXAM, Selection Board, and Physical.	
AUTHORIZATION		District commandant or CNARESTRA					Bureau of Naval Personnel		

* Recommendation by commanding officer required for all advancements.

† Active duty periods may be substituted for drills and training duty.

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Parachute Manual, NW 13-5-501

CHAPTER 1

THE PARACHUTE RIGGER RATING

Many men engaged in a great number of specialized fields are needed to maintain the Navy's air arm in a condition of constant military readiness. All these specialists are mutually dependent, and each contributes his part to the efficient operation of the entire organization.

The Parachute Rigger is an important member of this team of specialists which keeps naval aviation the most potent force of its kind in the world. In fact, you could not have chosen a more self-satisfying field of work than that performed by the Parachute Rigger.

The Parachute Rigger has as his primary mission the business of saving lives, a mission equally important in peace as well as in war. One generally thinks of the aviator as trusting his life to the aircraft he is flying; but if for some reason the aircraft becomes disabled, the aviator probably would be doomed—except for the equipment that the Parachute Rigger has so expertly provided for such an emergency. With this equipment, aviators and their crews are able to abandon their disabled aircraft, parachute to safety and survive on land, at sea, or even in the arctic wastelands—all because the Parachute Rigger did his work well. He not only did his job well; he did it perfectly.

Everything the Parachute Rigger does must be done flawlessly. Perfection becomes the standard by which he lives. The man who approaches his daily work with a tongue-in-cheek attitude should look elsewhere for his advancement. Such an approach leads only to trouble—quick, certain, and in large quantities—when a man is working with lifesaving equipment.

The Parachute Rigger knows this, and the precept he always has before him is one that has never been improved upon where man works with his fellowman—the Golden Rule—"Do unto others as you would have them do unto you."

The Parachute Rigger (PR) rating was established in 1942, shortly after the beginning of World War II. Prior to that time, parachute rigging was performed by personnel of the Aviation Machinist's Mate and Aviation Metalsmith ratings along with their other duties. With the beginning of the war, the work of the Parachute Rigger had increased to such an extent that the Bureau of Naval Personnel established the Parachute Rigger rating.

Before describing the duties and responsibilities of the present-day Parachute Rigger, let us take a look at the latest revision to the enlisted rating structure and see just how the Parachute Rigger fits into the overall program.

ENLISTED RATING STRUCTURE

The enlisted rating structure is the primary tool for the classification of Navy enlisted personnel. It is a systematic alignment of occupational groups (rates and ratings).

Enlisted ratings are divided into a total of twelve groups, all ratings within a particular group being occupationally related. For example, all ratings relating to aviation are in group IX, the aviation group.

Jobs requiring basically the same aptitudes, knowledges, and skills are grouped under one rating. Within each rating are steps for advancement, and with each step there is an increase in pay. These steps, or pay grades, are rates within a rating. For example, PR3 is a rate within the PR rating.

TYPES OF RATINGS

Under the latest revision to the rating structure for enlisted personnel of both the Regular Navy and the Naval Reserve, there are three types of ratings—GENERAL, SERVICE, and EMERGENCY.

A general rating reflects qualification in all aspects of an occupational field and insures broadly qualified senior petty officers. A service rating reflects qualifications in some of the aspects of an occupational field and provides specialization where it is deemed desirable. An emergency rating reflects qualification in a civilian skill which is not identified in the peacetime Navy but is required to be identified in wartime.

PARACHUTE RIGGER RATING STRUCTURE

Under this realignment, the Parachute Rigger rating is composed of a general rating, PR. In other words, there are no service ratings; the general rating, PR, applying to all pay grades (E4 through E9) for personnel of both the Regular Navy and the Naval Reserve. This alignment insures broadly trained petty officers in all pay grades of the rating.

In case of war or other national emergency, specialization could be provided by establishing emergency ratings.

SCOPE OF THE PR RATING

According to the 1963 Revision of the Manual of Qualifications for Advancement in Rating, Parachute Riggers have the following duties and responsibilities:

Inspect, maintain, and repair parachutes, survival equipment, and flight and protective clothing and equipment.

Pack and rig parachutes.

Pack and equip rafts.

Repair and test oxygen regulators and liquid oxygen converters removed from aircraft.

Fit and maintain oxygen masks, flight clothing, antiexposure suits, and anti-g suits.

Test and service full pressure suits.

Operate and maintain carbon dioxide and oxygen shop transfer and recharge equipment.

Operate sewing machines.

Maintain and repair sewing machines.

Test safety belts and shoulder harnesses removed from aircraft.

Supervise operation of parachute lofts, oxygen shops, and survival shops.

Instruct personnel in the proper techniques of survival.

QUALIFICATIONS FOR ADVANCEMENT

The minimum requirements for advancement in rating are set forth in the Manual of Qualifications for Advancement in Rating, NavPers 18068-A, commonly referred to throughout the Navy as the "Quals" Manual.

In addition to serving as a guide for enlisted men in preparing for advancement, the "Quals" Manual is also used as a guide in the preparation of Navy Training Courses, school curricula, and all Navy-wide advancement-in-rating exams.

The "Quals" Manual is kept up to date to meet the needs of the Navy by Revisions to the Manual, issued annually by the Bureau of Naval Personnel. The Manual is composed of two main sections, titled Military Requirements and Professional Qualifications.

Military requirements are the general qualifications which all enlisted personnel are expected to demonstrate as a minimum for advancement to specific pay grades. Professional qualifications are the requirements for advancement in a specific rating.

Requirements for advancement in the PR rating are itemized under the following subject-matter areas: Safety, Parachutes, Fabric Work, Flight and Protective Clothing and Equipment, Survival Equipment, Oxygen Equipment, and Administration.

Each of these areas is further broken down into Practical Factors and Knowledge Factors. The pay grade to which each Practical Factor and Knowledge Factor applies is listed under the "Required for Advancement to" column.

The Practical Factors are qualifications which state particular tasks that are carried out on the job and can best be tested by means of practical demonstration.

The Knowledge Factors are qualifications which include the minimum knowledges required for work performance. How well you know these qualifications is best shown by means of a written examination.

It should be kept in mind that before being recommended to take the advancement-in-rating examination you must complete all the Practical Factors applicable to the rate for which you are striking. As you show proficiency in each practical factor, a record of its completion will be made on a standard form titled, Record of Practical Factors, NavPers 760.

RECORD OF PRACTICAL FACTORS

The Record of Practical Factors, NavPers 760 (PR) provides a standard checkoff list of both military and professional practical factor qualifications required to be demonstrated in each pay grade as a prerequisite for advancement. Space has been provided on the form for your supervising officer to initial and enter the date of completion of each factor.

Each command maintains a Record of Practical Factors for each enlisted man in pay grades E3 through E8 (airman through senior chief). When you are transferred, your Record of Practical Factors will be signed, inserted in the correspondence side of your enlisted service record, and forwarded to your new duty station. In this way, your record will be kept up to date and used on a continuing basis as you progress in your rating.

You will be provided a personal copy of your record so that you can keep up to date on your progress. Your personal record will also serve as a reminder of things you must be able to demonstrate prior to advancement.

PARACHUTE RIGGER SCHOOL

The Parachute Rigger (Class A) School, located at Lakehurst, New Jersey, is designed to provide PR strikers with the understanding and knowledge which lead to the fulfillment of the technical requirements for advancement to Parachute Rigger, Third Class. The opportunity is provided to make one premeditated free-fall descent, using a parachute packed by the student, under the supervision of a qualified instructor. This is on a strictly voluntary basis after the man arrives at the school.

Entrance requirements to the PR(A) School are as follows:

Candidate must have a minimum GCT plus MECH score totaling 105. Twenty-four months of obligated service from the date of entry is required.

STUDYING FOR ADVANCEMENT

The Bureau of Naval Personnel issues many training publications for use by enlisted personnel in studying for advancement. These publications are listed for each individual rating in a booklet titled Training Publications for Advancement in Rating, NavPers 10052.

This booklet is revised and reissued annually and is the official bibliography of reference sources from which Navy-wide examination questions are taken. The latest edition is always available for reference in your education office and should be referred to prior to studying for advancement. Training courses which are marked with an asterisk (*) must be completed by passing the Enlisted Correspondence Course based on that training course, or by passing a locally prepared and administered test.

Another valuable reference source is the publication titled List of Training Manuals and Correspondence Courses, NavPers 10061. NavPers 10061 is an alphabetical listing (catalog) of all types of training publications, both officer and enlisted. This catalog is revised and reissued semiannually and includes the following alphabetical listings: Training Manuals, Navy Training Courses, Enlisted Correspondence Courses, and Officer Correspondence Courses. Preceding the listing of Enlisted Correspondence Courses is a section on the Enlisted Correspondence Program which outlines the function of the program and gives detailed instructions for making application for enrollment.

NavPers 10061 is distributed to all ships and stations, and the latest edition is always available in your education office.

NAVY TRAINING COURSES

Navy Training Courses are of three general types, each designed to aid the enlisted man in preparing for advancement. They are classed as General Courses, Basic Courses, and Rating Courses.

General Courses

General courses cover the military requirements required of all petty officers. Included as mandatory reading in this group are Military Requirements for Petty Officer 3 & 2 for advancement to pay grades E4 and E5, and Military Requirements for Petty Officer 1 & C for advancement to E6 and E7. Certain chapters of several other general courses are listed as recommended reading and may be used as sources for examination questions. For this listing refer to the current edition of NavPers 10052.

Basic Courses

Basic courses cover such fundamental subjects as blueprint reading, mathematics, use of handtools, basic electricity, hydraulics, and the like. As can be seen, subjects which are useful to more than one rating are covered in basic courses. Certain sections of the following basic courses are of interest to the Parachute Rigger.

Blueprint Reading and Sketching, NavPers 10077-B.

Basic Handtools, NavPers 10085-A.

Basic Machines, NavPers 10624.

Rating Courses

Rating courses cover the professional qualifications for a specific rate or rates. The "Quals" Manual is used as a guide in preparing rating courses. This means that each qualification in the "Quals" Manual is covered either by adequate material in the rating book itself, by reference to a basic course, or by reference to some other satisfactory and readily available publication.

Rating courses are revised from time to time to keep pace with new developments in equipment, as well as to comply with changes to the "Quals" Manual. In studying for advancement, always check the current edition of NavPers 10052 for the date of the latest issue of your rating course or courses.

ENLISTED CORRESPONDENCE COURSES

An Enlisted Correspondence Course consists of an assignment booklet, a set of answer sheets, and textbook, the textbook being the training course upon which the correspondence course is based. Correspondence courses are prepared for the purpose of helping you get the most out of your Navy Training Courses. The assignments focus attention upon various types of information, including important definitions, reasons why certain operations are performed in a special manner, the cause and effect of various actions, the similarity or difference between related objects, the recognition and identification of errors, the orderly arrangement of steps in an operation, and common principles which apply to two or more situations.

In working out correspondence course assignments, you should discuss difficult points with shipmates; however, the answers selected should be your own.

As mentioned earlier in the chapter, the current edition of Training Courses and Publications for Advancement in Rating, NavPers 10052, lists the Navy Training Courses which are mandatory. (Look for the asterisk (*) following the training course title.) One column of the listing indicates the Enlisted Correspondence Courses (ECC) meeting these Navy Training Course requirements. Other publications recommended for study are listed and some of these have associated Enlisted Correspondence Courses.

An alphabetical listing of Enlisted Correspondence Courses also may be found in the current issue of List of Training Manuals and Correspondence Courses, NavPers 10061, described earlier in the chapter.

THIS TRAINING COURSE

This training course is based on the professional qualifications for the rates of PR3 and PR2, as set forth in the "Quals" Manual (through the 1963 revision). It is designed primarily for use by the striker who is studying for advancement to PR3 and the PR3 who is studying for advancement to PR2.

Satisfactory completion of this training course is mandatory before you can become eligible to participate in the advancement-in-rating examination. Keep in mind, completion of this course may be accomplished by passing the Enlisted Correspondence Course or by passing locally prepared and administered tests.

SUGGESTIONS FOR STUDYING

Here are some ways that have been found to be effective by men studying Navy Training Courses for advancement.

Start by reading the preface, table of contents, and index. Then thumb through the entire book, looking at the illustrations and reading bits here and there as your eyes fall on something interesting. This browsing will show you how the book is organized and the subject matter it covers.

Next, preread the entire course. Do this to learn the relationship of parts and chapters to the whole of the rating covered in the course. Read the introductions to each chapter. Then read the headings and subheadings. Ask yourself such questions as: What do I already know about this particular topic? How are these topics interrelated? What am I expected to know about this process or technique?

Learn the qualifications for advancement in your rating. You are studying the NTC in order to meet these "quals."

These preliminary steps orient you and help you plan your study. They put you in a better position to draw on personal experience and to relate your past experience to the new material.

After this preliminary work you are ready to fill in the details by intensive study of the chapters, sections and subsections. What you can cover during a study session depends on (1) the difficulty of the material; (2) what you already know about the topic; and (3) your skill as a reader. At any rate, for each study session plan to master a predetermined unit of material: an entire chapter or a major section of a chapter.

Use the PREREADING system with each section and paragraph. Skim the introduction, headings, first and last sentences of each paragraph, and all summarizing statements. As you preread, think up questions about the material. Write down these questions for future reference. Another useful technique is to make an outline during prereading, filling in the details later. When you have finished prereading, think about what you have learned thus far. Ask yourself such questions as: What main ideas are presented? What details must I look for?

Next, read the entire chapter or section completely and carefully. As you read be on the lookout for the questions you have thought about or the details of your outline. Relate the part to the whole. Relate your previous knowledge and background experience to the discussion. Identify yourself with the situations, processes, and techniques; visualize yourself doing the things that are described.

Recite what you have learned. This is the proof of understanding. Look at the questions you wrote down during prereading. Do you know the answers? Try to master the material you are studying before proceeding to a new portion of the text.

THE PARACHUTE LOFT

The parachute loft is the servicing headquarters for parachutes and other related lifesaving equipment such as rafts, vests, and pressure suits. The term "loft" is probably a misnomer, since the only lofty part of the structure is the tower, where the parachutes are aired and dried.

The parachute loft ashore is generally located at ground level and in the vicinity of the hangars and flight line. The loft aboard a CVA type carrier is generally located on the 02 deck; however, the dry locker will be found on the hangar deck.

Figures 1-1 and 1-2 show typical examples of the general arrangement of equipment in the parachute loft ashore and afloat, respectively. As shown in these illustrations, the main items of equipment are packing tables, sewing machines, and storage bins.

The parachute loft is generally divided into a parachute packing section, fabric work section, dry locker, and survival (or flotation) equipment section.

The packing section is devoted to packing, rigging, and inspecting parachutes. Quite naturally, the packing tables occupy the greatest portion of this section.

Cleanliness is an important item in the packing section. Tables should be kept clean and waxed. Every effort should be made to keep all contacting surfaces and edges smooth, thus preventing snagging of the parachute canopy and lines.

The fabric work section is composed mainly of sewing machines and cutting tables. Any number of small items such as measuring instruments, and cutting, stapling, and setting tools are stowed in lockers.

The dry locker, or tower, is distinguished by its boxlike height, towering over the adjoining building. The height of the dry locker is determined by the length of the parachute from the peak of the canopy to the ends of the leg straps on a seat or back type harness. A 28-foot parachute, suspended freely, requires a height of approximately 45 feet.

The survival, or flotation, equipment shop is used for the maintenance of rafts, vests, antiexposure suits, and many smaller items of survival gear. Although this shop is a part of the parachute loft, it must occupy a separate room of the building or be located in a nearby building. Talcum powder, cements, and solvents, used in flotation equipment maintenance, are harmful to parachutes.

SAFETY IN THE LOFT

Since safety is the Parachute Rigger's stock in trade, every man assigned to the loft should be thoroughly familiar with safe working habits. A careless attitude invariably leads to careless working habits. There is no place in the parachute loft for "skylarking." Unsafe conditions or working habits should be reported to the chief in charge of the loft.

Each chapter of this training course lists the standard safety precautions for the particular equipment with which it deals; however, some of the general precautions which should be observed are listed below.

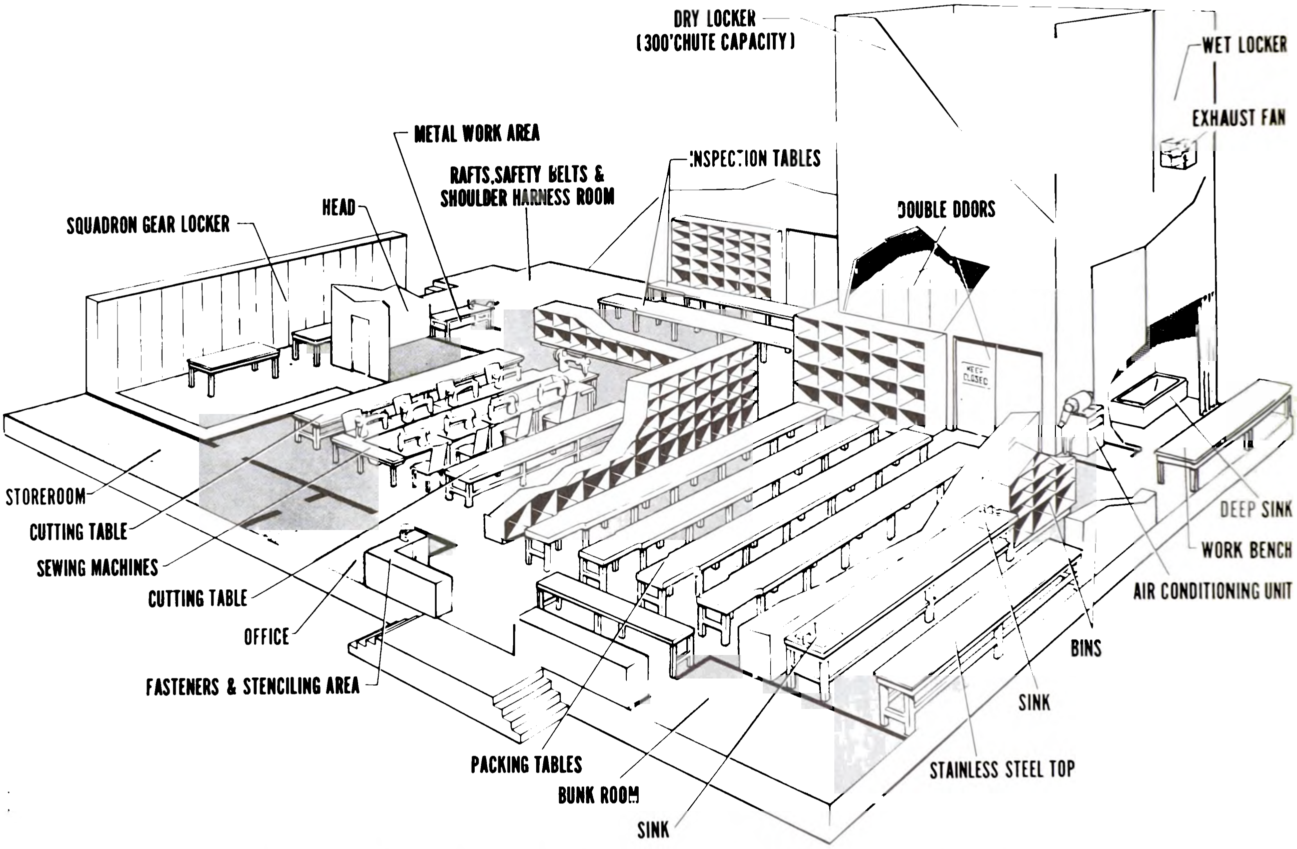


Figure 1-1.—Typical parachute loft arrangement (ashore).

1. Sharp, clean tools and the right tool for the job should be used at all times.
2. Tools should be handled and stored in a safe manner.
3. Working areas and passageways should be kept free of hazardous obstructions.
4. Materials should be securely stacked so that there is no danger of tipping.
5. Flammable materials must be kept in designated spaces.
6. Lockers should be kept in a clean and orderly condition and adequately ventilated.

THE OXYGEN SHOP

The oxygen shop is devoted to testing and maintaining oxygen regulators and converters, recharging oxygen and carbon dioxide cylinders, and testing aviator's breathing oxygen. If pressure suits are used locally, the pressure suit shop may also be located within the oxygen shop.

A well-equipped oxygen shop is generally provided with the following basic equipment: Oxygen recharge equipment, oxygen regulator test equipment, vacuum pump, oxygen water vapor indicator, halide detector, oxygen recharge trailer, pressure suit test equipment, and carbon dioxide recharge equipment.

Although most of the above listed equipment is normally operated by Parachute Riggers in the higher pay grades, lower rated PR's must be familiar with the hazards involved in working with oxygen and know how to cope with these hazards. All Parachute Riggers should be familiar with the following oxygen handling safety precautions:

1. Keep oil and grease away from oxygen and oxygen equipment. This is the primary rule to remember.
2. When attaching an oxygen transfer line, always make certain the connections are clean, dry, and in good condition before cascading or pumping oxygen.

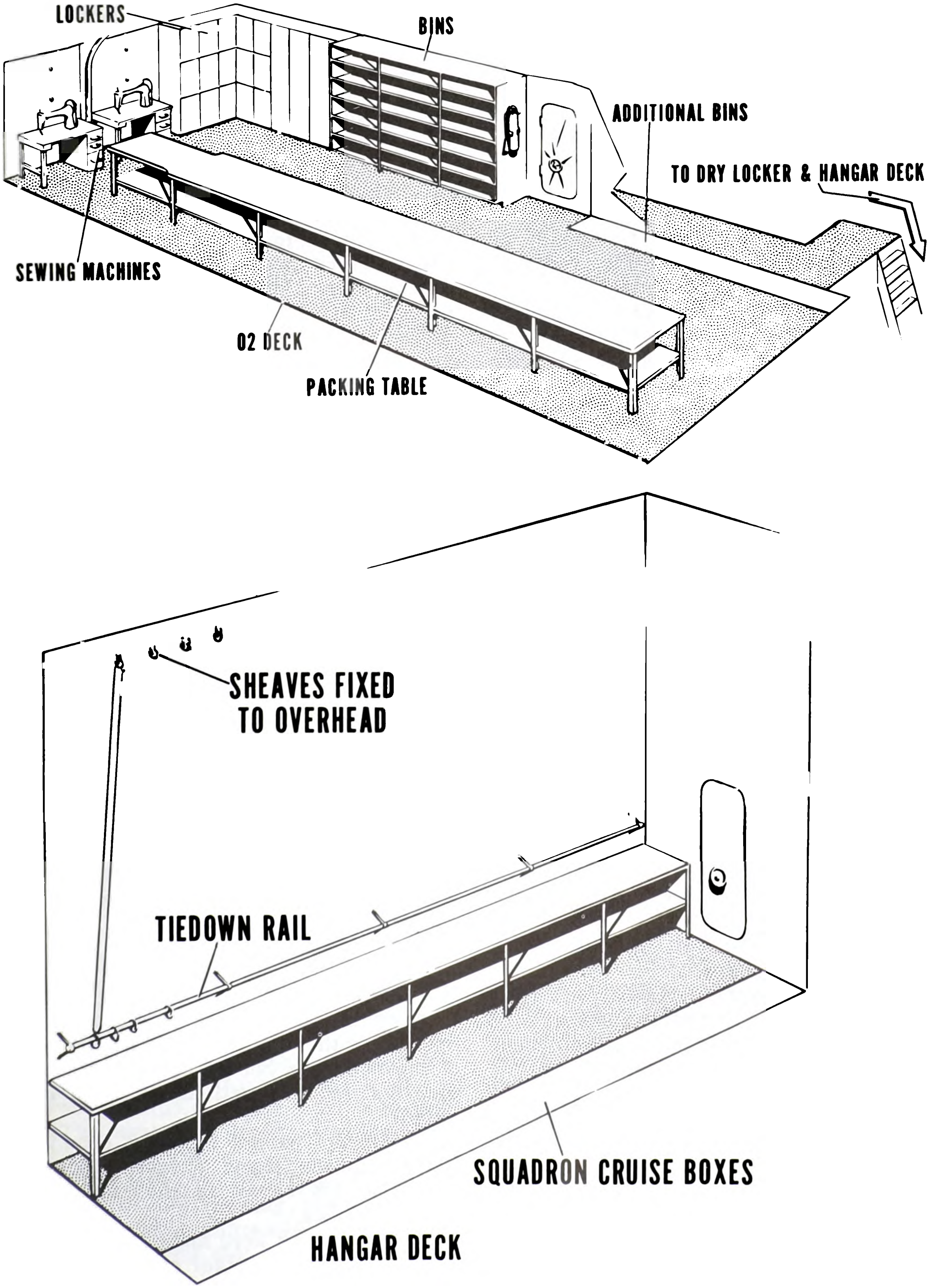


Figure 1-2.—Typical parachute loft arrangement (afloat).

3. When cascading or pumping oxygen, have someone standing by who can positively shut off the flow in the event of an emergency.

4. Handle cylinders carefully and never drop or bump them.

5. Never use cylinders as rollers for moving heavy equipment.

6. Do not drag or slide cylinders across a deck or the ground.

7. Never mix oxygen with other gases.

8. Never completely expend the supply of oxygen from a cylinder. Always leave a residual pressure in excess of 15 psi.

9. Do not leave oxygen cylinders near any extreme source of heat.

10. Never fill a lower pressure capacity cylinder without an approved pressure reducing valve.

11. Never use any piece of equipment before understanding its purpose and use.

12. Never leave a trailer cascading system turned on after use.

13. Never leave filling connections exposed to the weather.

14. Never set a filling connection down on the deck or ground.

15. Once pressure is on a flexible filling line, never let go of it.

16. Always replace protective thread and end-of-line caps.

17. Never use oxygen filler lines for any gas other than pure dry oxygen, nitrogen, or water pumped dry air. (Water pumped air does not contain the slightest trace of oil or grease, and is usually more difficult to obtain than the nitrogen.)

18. Never use anything but an approved cleaning agent for cleaning external oxygen fittings.

19. Never permit the use of electromagnets in handling oxygen cylinders.

20. Never hoist oxygen cylinders with rope or chain slings. Handle with cranes and specially built cradles, using cable straps to protect them from shifting.

21. When transporting in trucks, storage cylinders should be securely fastened together in an upright position.

22. Protect stored cylinders from excessive temperatures. (Maximum temperature 130 F.)

23. Protect cylinders from the direct rays of the sun.

24. In winter protect cylinders from snow and the formation of ice.

25. Keep cylinders away from flammable materials.

26. Store empty cylinders separately from the full cylinders.

27. Tag or mark empty cylinders. Cylinders are considered empty when less than 50 psi pressure remains.

28. Always replace protective valve caps on storage cylinders when they are not in use.

29. Never use greasy rags or wear greasy clothes, or cosmetics (hair oil, lip salve, etc.), when working around oxygen equipment.

There are a number of additional safety precautions to be observed when handling liquid oxygen. Some of these parallel the safety precautions outlined for the handling of gaseous oxygen; however, they are worth repeating to insure against accidents. Any possible danger that may occur is based on these general characteristics of liquid oxygen. First, the rate of combustion of most materials can be greatly increased by liquid oxygen; second, contact with liquid oxygen can cause severe frostbite and damage to equipment vulnerable to freezing conditions; and third, liquid oxygen, if confined, will eventually evaporate and build up a tremendous pressure which could result in the rupture of the tank in which it is stored. Because of these possibilities, the following safety precautions must be observed:

1. Do not operate liquid oxygen equipment unless you are qualified or are working under the supervision of qualified personnel.

2. Wear goggles or a face shield when handling liquid oxygen.

3. Do not handle with bare hands any tubing or fittings through which liquid oxygen is flowing. Wear clean, dry gloves when handling parts of equipment cooled by liquid oxygen. (Temperature of liquid oxygen is -297°F.)

4. In the event that liquid oxygen is spilled on clothing, remove the clothing immediately. In case the body comes in contact with liquid oxygen, or there is reason to suspect some part of the body has been frozen or chilled, follow the first aid instructions on the nearest first aid kit.

5. Do not permit smoking, open flames, or sparks in the liquid oxygen handling areas.

6. Do not carry matches in liquid oxygen handling areas.

7. Keep work area and equipment free from oil, grease, or any other combustible material.

8. Keep tools and clothing free from oil and grease.

9. Avoid spilling liquid oxygen on floor or deck areas. In case of accidental spillage, thoroughly ventilate the area.

10. Always call oxygen by its proper name. Do not confuse it with compressed air. Never use oxygen in place of compressed air for any purpose.

11. Handle converters, storage tanks, and transfer hoses with care to avoid damage to the insulating space.

12. When transferring liquid oxygen, do not leave valves open all the way. Open valves wide, then immediately close them about one quarter turn; otherwise they may freeze in the open position.

13. Disconnect filling or transfer lines as soon as the transfer process is completed.

14. Do not leave liquid oxygen in a closed container or trapped in a line between two valves; always open a valve on one end to avoid excessive pressure buildup.

15. Use only standard approved equipment in the handling and storage of liquid oxygen.

ASSIGNMENTS AVAILABLE TO PR3 AND PR2

As a PR3 or PR2, you may be attached to any one of the three types of aircraft maintenance activities—a squadron, an air station, or the air department of an aircraft carrier. Regardless of which type of activity you are attached to, you will more than likely be assigned to the parachute loft or the oxygen shop.

THE SQUADRON

The squadron is the standard operating unit in naval aviation. Each squadron has a number of assigned aircraft; the number and type depending upon the mission of the squadron (fighter, attack, patrol, etc.). Each squadron is also assigned a number of personnel for operation, maintenance, and repair of its aircraft and equipment and maintenance and repair of the pilot's and aircrewmen's flight clothing and survival equipment. The number of personnel will depend upon the type of squadron.

All squadrons (regardless of type) are made up of a number of departments, the largest of which is the aircraft maintenance department. It is to this department that you are likely to be assigned.

As a member of the maintenance department of a squadron, you are likely to be assigned to the aviators equipment branch. Other branches are powerplants, avionics, ordnance, and airframes.

Within the aviators equipment branch are the parachute loft and the oxygen shop, both of which are under the supervision of a senior Parachute Rigger. As a Parachute Rigger striker, your work will depend upon the type of squadron and the number of Parachute Riggers assigned to the squadron. In one outfit, you may be assigned to the parachute loft; while in another, your work may be confined to the oxygen shop. In still another, you may be working in both the parachute loft and oxygen shop. In any case, you will be working with a qualified Parachute Rigger who will instruct and train you in the proper use of shop equipment and in performing the duties of your rate.

THE NAVAL AIR STATION

Parachute Riggers and Parachute Rigger strikers attached to a naval air station are assigned to the aviators equipment branch of the shops division. Although the organizational setup is similar to that of the squadron, everything is on a much larger scale.

More aircraft must be maintained and any number of different types and models are likely to be involved. While the average squadron will have only one or two different types of aircraft to maintain, an air station will generally have several different types. Naval air station personnel not only service and maintain their own assigned aircraft but also transient aircraft. They also assist any squadrons which may be stationed there. This makes the work of the Parachute Rigger much more varied and on a much greater scale.

The aviators equipment branch is generally broken down into four sections—oxygen, parachutes, pressure suits, and flotation equipment (rafts and vests). As a striker, you may be assigned to any one of these shops where you will be instructed and trained in performing the duties of your rate.

THE AIRCRAFT CARRIER

Parachute Riggers attached to an aircraft carrier are assigned to the aircraft maintenance division of the air department. Ship's company personnel provide the same service to embarked squadrons as naval air station personnel do ashore. Of course, shop spaces are on a much smaller scale, and all work must be done on a much tighter schedule.

CHAPTER 2

PARACHUTE FAMILIARIZATION

In 1495, shortly after Columbus discovered America, another great Italian, Leonardo da Vinci designed the first parachute. This was a huge pyramid of cloth, but a functional parachute was not actually made and used until more than a century later. The word "parachute" is derived from the Italian word "parare," meaning to protect or shield from, and from the French word "chute," meaning a fall or quick descent—literally, "to protect from a fall."

Fouste Veranzio, also an Italian, is given credit for the first parachute jump. He made this jump in 1617 from a tower in Venice, using a parachute made of a square wooden frame, covered with canvas. Since man had no use for a lifesaving device of this nature, parachutes were considered novelties or items of amusement, and interest in them gradually dwindled. It was not until the invention of the first aerial balloon that interest in the parachute was renewed.

In 1783, the Montgolfier brothers invented a balloon which would stay aloft. This balloon was kept in the air by burning bundles of straw beneath the bag to make the necessary supply of hot air. If the fabric should catch fire the flight was abruptly ended. This meant that men who went up on such flights had to have a means of escape and descent. This necessity for a lifesaving device removed the parachute from the list of novelties.

In 1808, Andre Kuparento, a Polish balloonist, became the first man to leap to safety from a flaming bag of hot air, using a parachute. The need for a foolproof parachute, however, did not become sufficiently acute to stimulate a great deal of inventive effort until nearly 100 years later.

Then, with the coming of the air age in 1903, when the Wright brothers made their spectacular flight at Kitty Hawk, North Carolina, there came also an era of experimentation with parachutes designed especially for the new type of aircraft.

Captain Albert Berry is given credit for being the first American military man to successfully jump from an airplane using a parachute. This jump was made in 1912. His parachute was packed in a cone-shaped metal cylinder with a trapeze bar serving as a harness, and the weight of his body pulled the canopy from the container. Many others using makeshift or experimental parachutes made descents before World War I, but parachutes still were not considered as essential equipment for military aviators. The resultant mortality rate among pilots on active duty at the front during the war was very high. This, together with the fact that the lives of 800 balloonist observers and artillery fire directors were saved by parachutes, pointed out a desperate need for a foolproof, lifesaving device. The next logical step then, was to improve parachute reliability and make them mandatory for military aircraft.

With World War II, when the number of naval aircraft was increased tenfold, the parachute became more and more important and its improvement became an important objective of the Navy. Pursuing this objective led to the development of the Naval Parachute Experimental Unit at El Centro, California. This unit is now called the Joint Parachute Test Facility and is operated jointly by the Navy and Air Force. The unit must test and approve any change to the parachute and/or any component, and is responsible for the design and testing of many items now in use, such as the integrated harness, the rigid, high-speed type pack of the NB-9, and many others. This Joint Parachute Test Facility, along with the Aircrew Equipment Laboratory, Naval Air Material Center, Philadelphia, Pennsylvania, enables personal survival gear development to keep abreast of the design and development of newer and faster aircraft.

PRINCIPLES OF OPERATION

A parachute is made like a giant umbrella nd protects a falling body from severe injury r damage in landing by offering a large air-esisting surface. In each successful parachute escent the same action takes place—the ripcord s pulled, the pilot chute emerges from the ack, and pulls the main canopy out. The canopy ills with air and lowers the body slowly to he ground. This series of events is illustrated n figures 2-1 through 2-7.

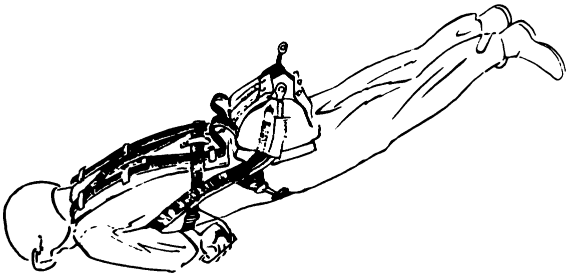


Figure 2-1.—Exerting a pull in excess of 22 pounds on the ripcord releases the ripcord pins from the locking cones. The flaps of the pack are then drawn back by spring-opening bands.

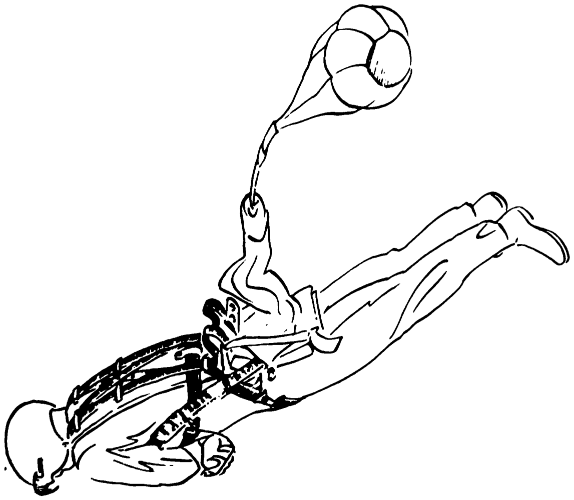


Figure 2-2.—The pilot chute springs beyond the negative pressure area immediately above the falling body. This results in its getting a better "bite" on the surrounding air, thus speeding the opening of the canopy.

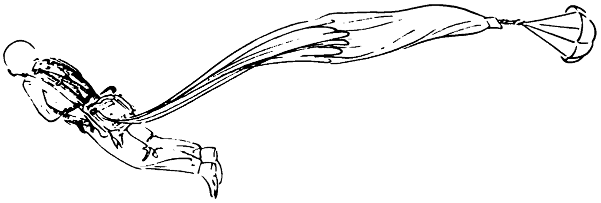


Figure 2-3.—Canopy completely extended. Suspension lines almost completely out of pack.

DESIGN AND CONSTRUCTION

A parachute consists of five major parts: the pilot chute, the canopy, the suspension lines, the pack, and the harness. The pilot chute is a small parachute attached to the top of the main canopy. Its purpose is to retard the main canopy while the weight of the falling body withdraws the suspension lines and inflates the canopy. The canopy is a large area of cloth which slows the descent of the falling body. The suspension lines are strong lines which join the canopy to the harness. The pack is a nylon assembly which encloses the pilot chute, canopy, and suspension lines. The harness is an arrangement of nylon webbing and metal fittings. It is designed to hold the canopy securely to the jumper and provide a seat or sling during descent.

TYPES OF PARACHUTES

There are three basic types of parachutes now in service use by the Navy. These are the Navy chest type (NC), the Navy seat type (NS), and the Navy back type (NB). All Navy parachutes are placed in one or the other of these categories and as new developments and modifications occur they are indicated by a modification number following the letter designation. For example, in the NB-9, the 9 indicates that this is the 9th modification of the Navy back (NB) type parachute. An oversize harness may be used with the NS type parachute; therefore, the letter "R" indicating regular size harness, or the letter "O" indicating an oversize harness, is also included after the model number as a part of the letter designation; i.e., NS-2R.

NAVY CHEST TYPE PARACHUTE

The Navy chest type is attached to the harness with quick connector hardware and is worn on

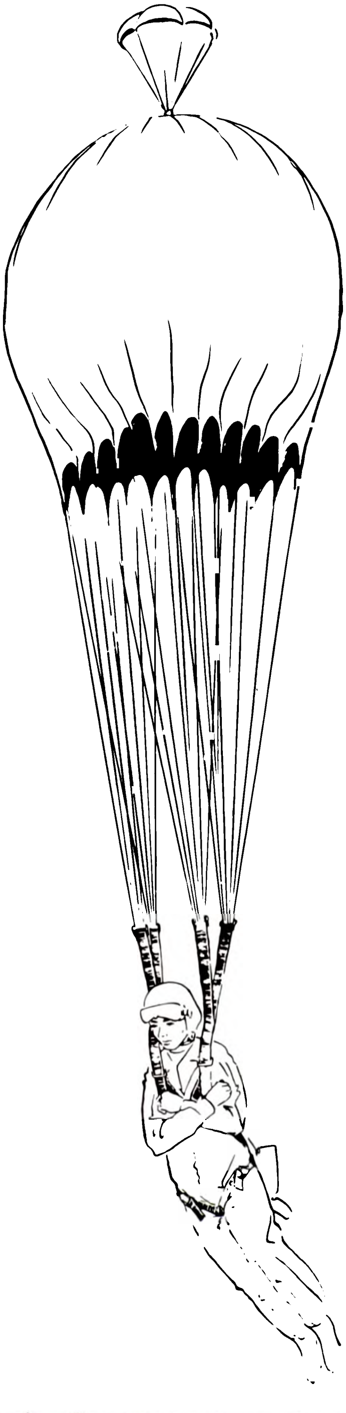


Figure 2-4.—Canopy filling with air. Body assuming upright position.

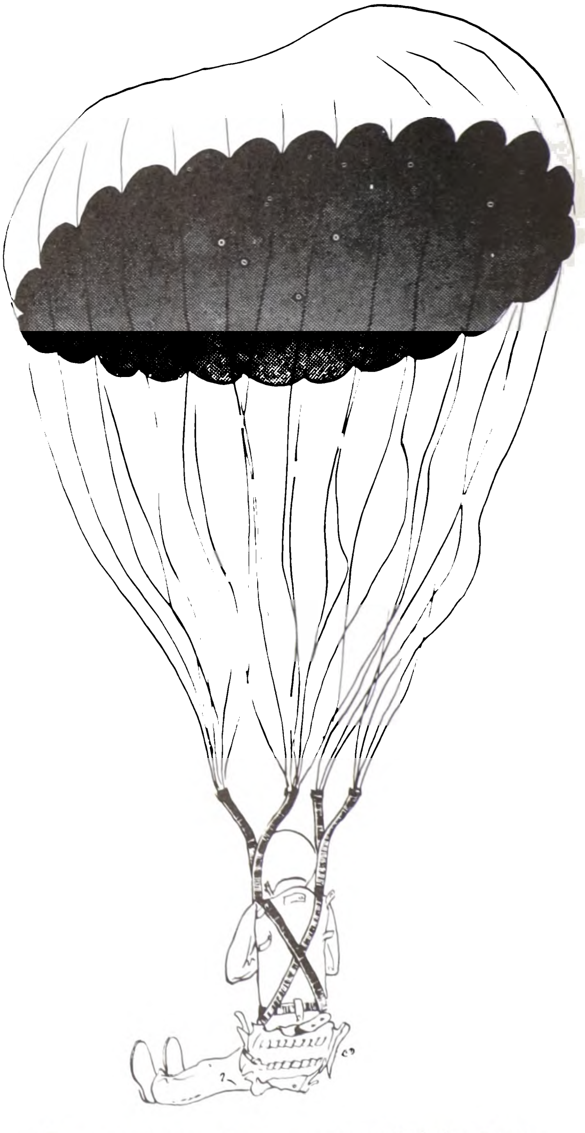


Figure 2-5.—Canopy completely open. Opening shock felt.

the chest. (See fig. 2-8.) It was designed fo use in aircraft where duties of the pilot an crewmen require them to have freedom o movement in various sections of the aircraft When the chest type parachute is used, th harness must be worn at all times during flight

The pack is usually stored in a spot nea the individual's flight station or bailout station allowing maximum efficiency of the crewma and still providing a high degree of safety. Thi accessibility of the pack allows quick attachmen of the parachute before bailing out.

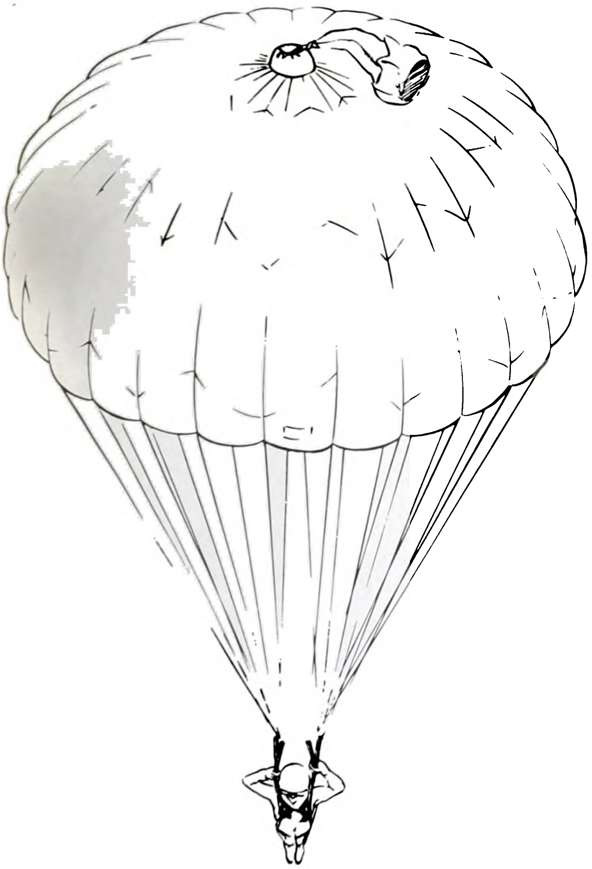


Figure 2-6.—Steady rate of descent established. Pilot chute resting on canopy.

To be completely effective, it is necessary that every person using a chest type parachute be properly trained in its use. It is obvious that each person aboard an aircraft should be continuously aware of the exact location of his pack at all times.

NAVY SEAT TYPE PARACHUTE

The seat type parachute (fig. 2-9) is the oldest type still in service use. It is designed to be worn as a seat for the wearer, and when in use, fits in the bucket section of the aircraft seat.

It was designated the SS (Standard Seat) when first used in 1924. It continued in use with the same designation and very little change to its design until well into the 1940's.

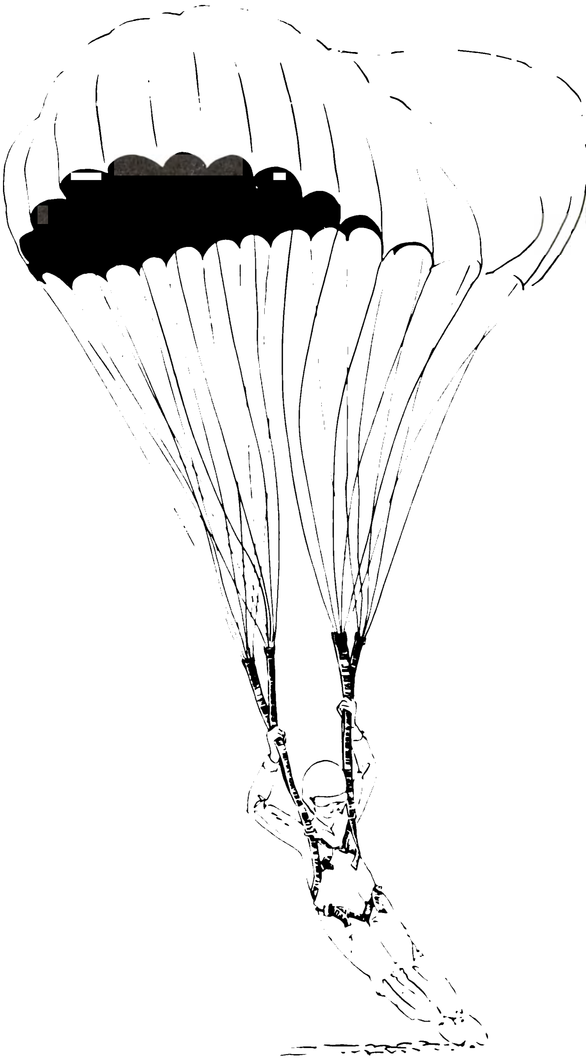


Figure 2-7.—Parachute deflating as body touches ground.

World War II created a necessity for differer designs in parachutes to fit the requirement of newer types of aircraft. This led to th design of the Quick Attachable Seat (QAS parachute. This parachute was designed to b left in the seat of the aircraft and quickl attached to the pilot's harness. This would hel him in getting in and out of the aircraft a well as speed the launching of aircraft.

A later development of this parachute wa the Quick-Fit Seat (QFS). This one could also b left in the cockpit of the aircraft, but the harnes was permanently attached to the parachute ar could be quickly adjusted by the wearer.

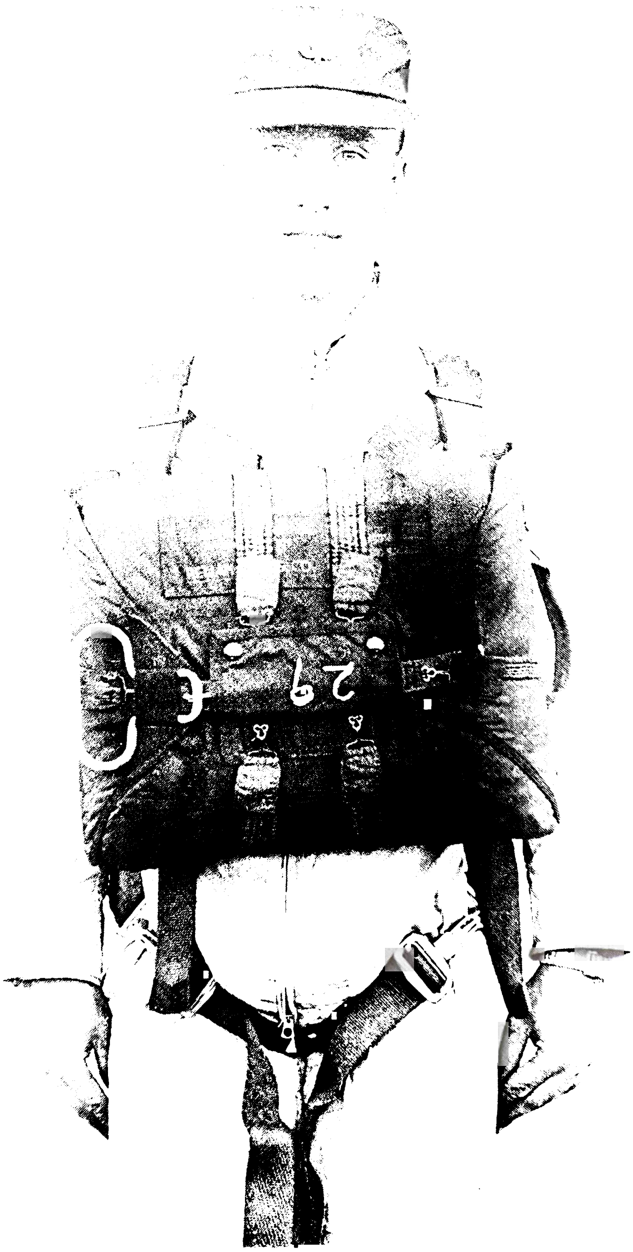


Figure 2-8.—Navy chest type parachute.

In 1948 all parachutes were redesignated and given their current designations. It was then that the QFS became the NS-2R.

NAVY BACK TYPE PARACHUTE (NB)

The Navy back type parachute is worn on the back, as shown in figure 2-10. Although early

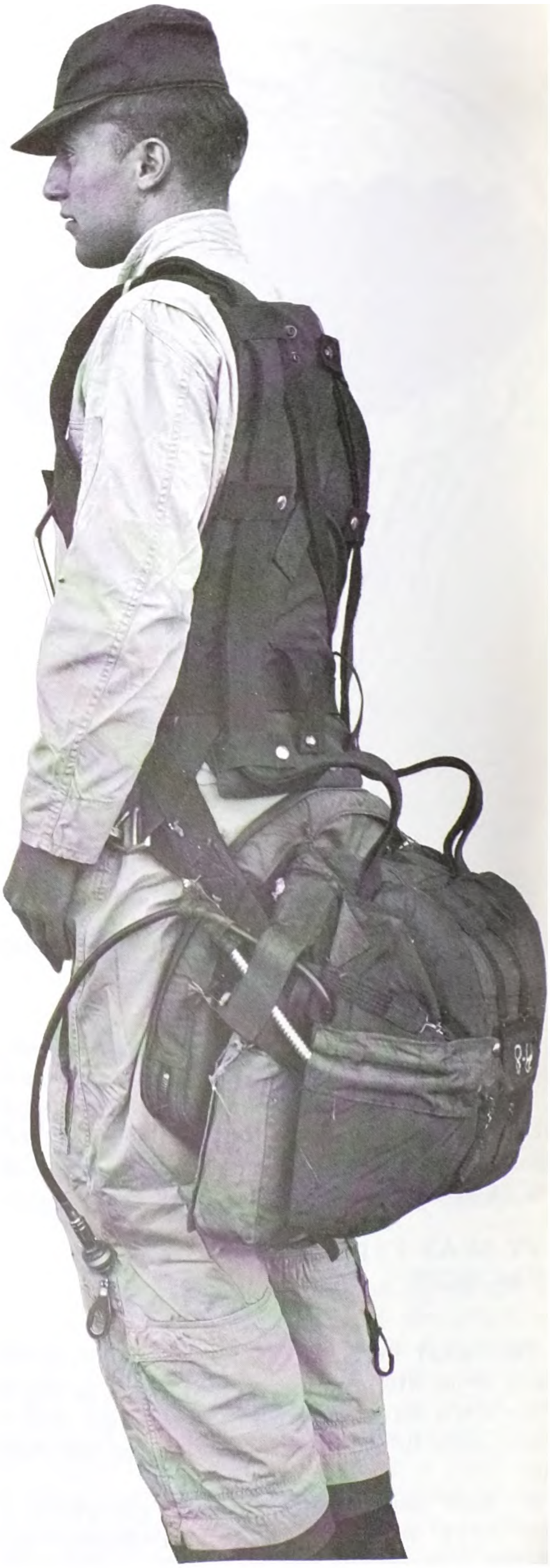


Figure 2-9.—Navy seat type parachute (NS-2R).

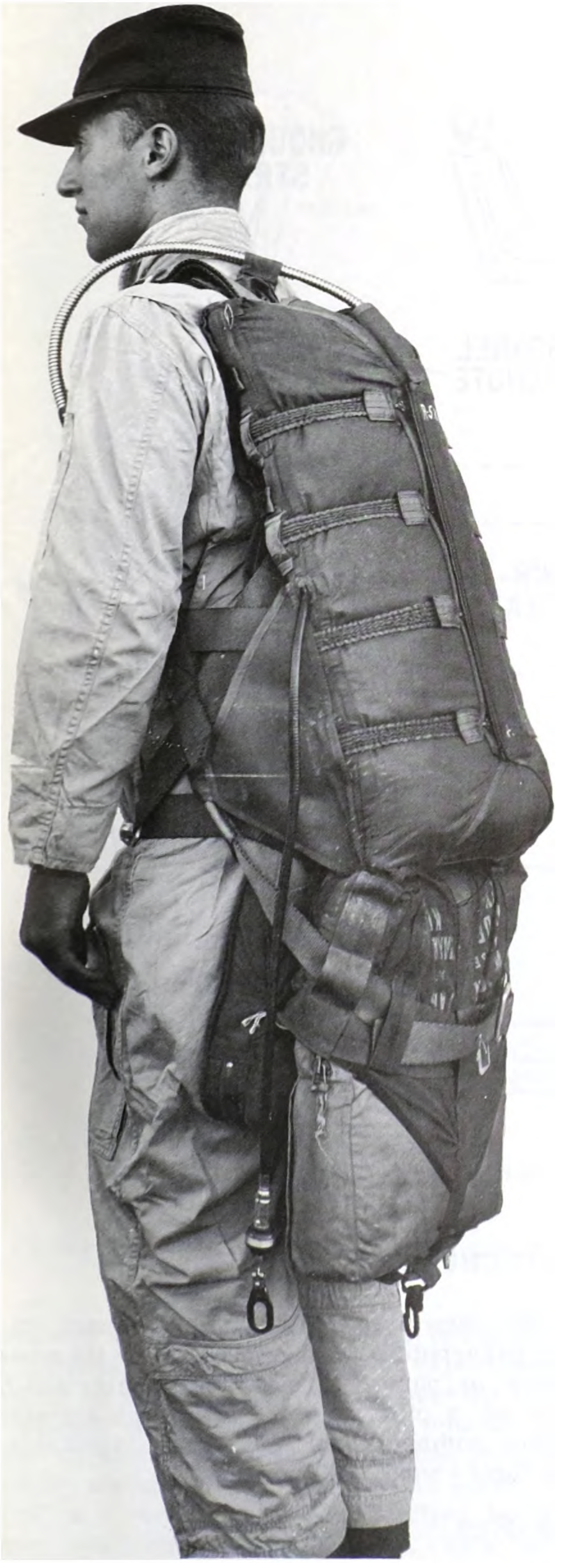


Figure 2-10.—Navy back type parachute (NB) with PK-2 pararaft attached.

models of the back type saw very little service use, later designs are ideally suited for use with jet-powered aircraft, the ejection seat, and its automatic devices.

Parachutes of this type are the NB-5, NB-6, NB-7, NB-7E, NB-8, and NB-9. The NB-5, NB-7, NB-7E, and NB-9 are designed to be worn with the integrated harness, and are a part of the ejection seat escape system. The integrated torso harness (fig. 2-11) incorporates the shoulder harness, lap belt, and parachute harness into one assembly.

Figure 2-11 illustrates the NB-7 adapted for use with the Rocket Assisted Personnel Ejection Catapult (RAPEC) escape system. By installing an automatic actuator (a device which opens the parachute automatically at a preset altitude), all back type parachutes may be used with the ejection seat escape system.

MARTIN-BAKER PARACHUTE

Another type of integrated parachute not previously mentioned is the Martin-Baker. This parachute has a 24-foot canopy enclosed in a horseshoe-shaped back pack, specially designed for use with the Martin-Baker ejection seat. The horseshoe-shaped pack is designed to provide the proper ejection posture or attitude by means of the shoulder harness and takeup mechanism. This parachute is discussed more completely in chapter 8.

TRAINING TYPE PARACHUTE ASSEMBLY

For all practical purposes the training outfit may be considered as a standard back pack parachute with a chest pack attached to the same harness. Bureau of Naval Weapons regulations, like those of the Federal Aviation Agency, require that two packs be worn when making training or demonstration parachute jumps. The training assemblies are designated the NT-5R or NT-50, depending on whether the flat circular canopy is a 28-foot (regular) or a 32-foot (oversize) one.

The training outfit is rarely used in the Navy except at Parachute Rigger School, Lakehurst, New Jersey. In order for naval personnel to make a premeditated parachute jump at other than this activity, it is necessary to pass a rigid physical examination and to have obtained, through the chain of command, the permission of the Chief of Naval Operations.

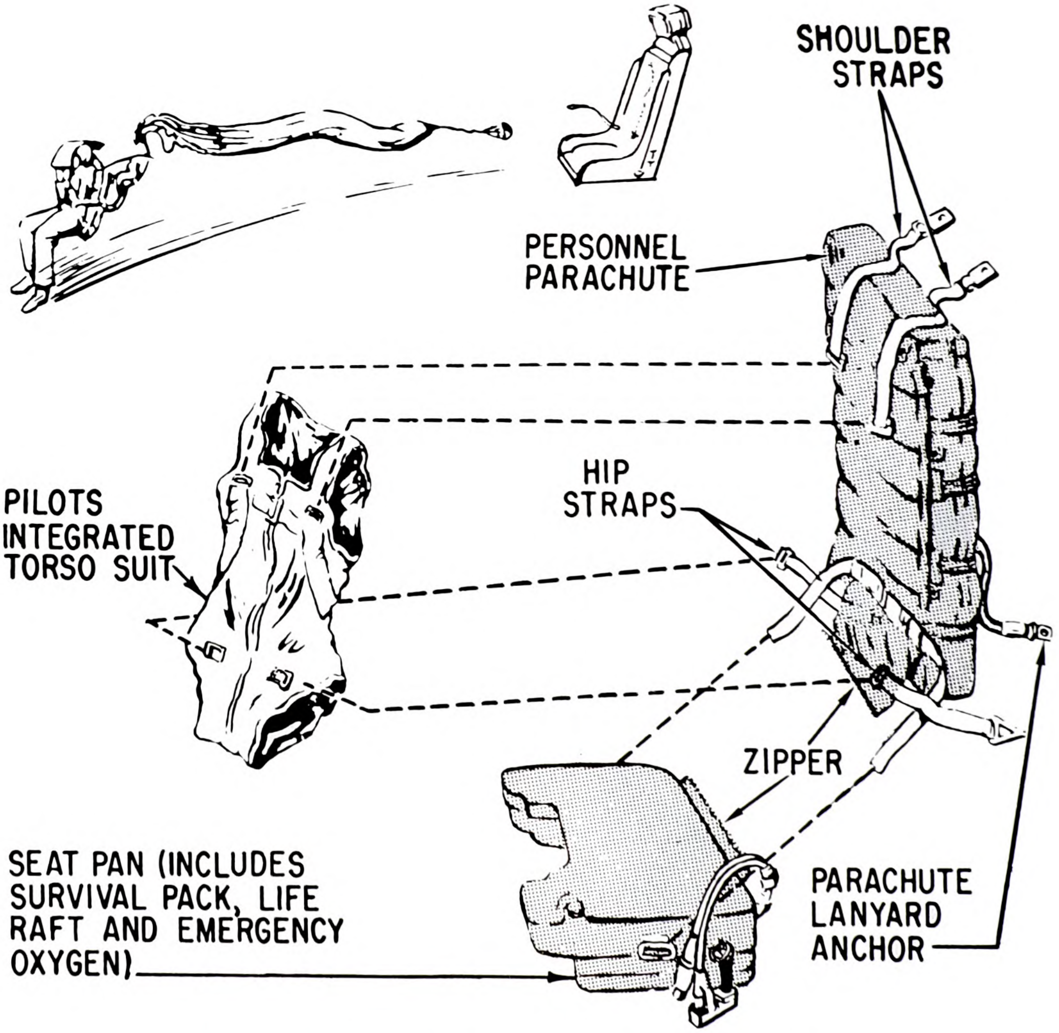

SHOULDER STRAPS
PERSONNEL PARACHUTE
PILOTS INTEGRATED TORSO SUIT
HIP STRAPS
ZIPPER
SEAT PAN (INCLUDES SURVIVAL PACK, LIFE RAFT AND EMERGENCY OXYGEN)
PARACHUTE LANYARD ANCHOR

Figure 2-11.—NB-7 parachute with accessories.

COMPONENTS OF PARACHUTES

The design and construction of a parachute and its components are based on the old idea that a chain is only as strong as its weakest link. Every link from the jumper to the canopy must carry its share of the maximum load applied during the opening shock.

The five major parts of a standard service parachute, starting at the top and working down, are the pilot chute, main canopy, suspension lines, harness, and pack. Figure 2-12 illustrates these five major parts.

PILOT CHUTE

The vane type pilot chute is used on al Navy parachutes. Figure 2-13 shows the nomenclature or names of parts and materials tha make up a pilot chute. A thorough knowledg of this nomenclature will prove invaluable i your future work with parachutes.

CANOPIES

The size and shape of the parachute canop have been controversial subjects since da Vinc

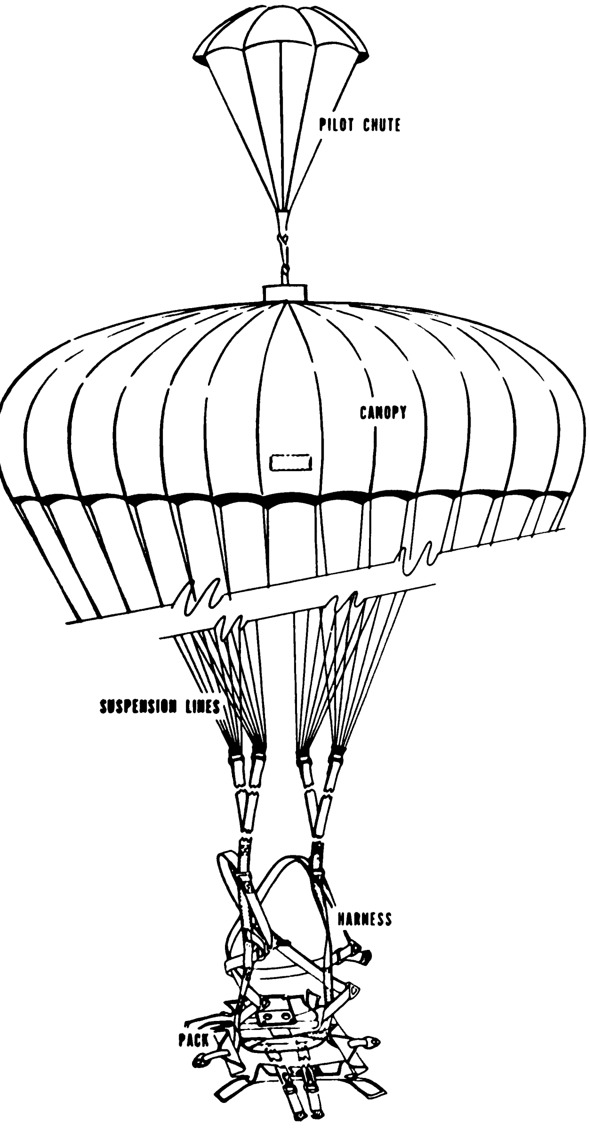


Figure 2-12.—The five major parts of a parachute.

visioned a pyramid of cloth as being a safe y of falling through the air. After experimenta- n with many different canopies over the years, o shapes have emerged as acceptable. One the standard flat design which has remained rtually unchanged for the past 30 years. The cond is a new idea in construction, but still llows the basic shape pattern. This latter nopy type is known as the 26-foot 22-gore ical canopy. This canopy is used with the -5 and NB-6 parachute assemblies. The "conical" reference comes from the fact that the peak of the canopy is conical in construction. In descent the canopy presents a slightly raised shape at the apex, but fails to radically change the basic appearance so familiar to the service.

Standard Flat Type

The 28-foot ripstop nylon canopy is the old standard size used on all Navy parachutes. The parachute canopy is described as a polygon, having 28 sides, a diameter of 28 feet plus or minus 1 inch, and 28 gores of 4 sections each.

The 28-foot canopy contains approximately 796 square feet of nylon cloth plus 2,400 yards of nylon thread. The sewing on a parachute varies from 8 to 11 stitches per inch. The parachute contains approximately one-half million stitches with a canopy area as great or greater than many 2-bedroom homes.

The suspension lines run continuously from the connector link on one side of the 28-foot canopy to the connector link on the other side as illustrated in figures 2-14 and 2-15.

The following additional items concerning the standard flat canopy should be noted:

1. Each gore is composed of four sections identified by the letters A, B, C, and D, starting with the bottom section.
2. Diagonal seams run parallel to the warp thread in the cloth, the warp changing direction with each gore. The sections are cut at a 45-degree angle to the centerline of the gore. This is called BIAS CONSTRUCTION and provides the maximum strength and elasticity.
3. The radial and diagonal seams are double lapped for security.
4. The suspension lines are enclosed in the channel produced by stitching the radial seams.
5. The vent acts as a relief valve and relieves the high internal pressure within the parachute at the instant of opening. Without this vent an opening at high speed could result in a dangerous rupture of the canopy.
6. The skirt and vent hems are reinforced with 1-inch nylon webbing to aid in preventing tears from completely separating the canopy.
7. The following is stenciled on the top center gore (section A of gore number 28) in letters 1/2 inch high and approximately 12 inches from the bottom of the canopy:

NAVAIRFAC
ORDER NO.
DATE OF MANUFACTURE AND SERIAL NO.
MANUFACTURER'S NAME OR TRADE MARK

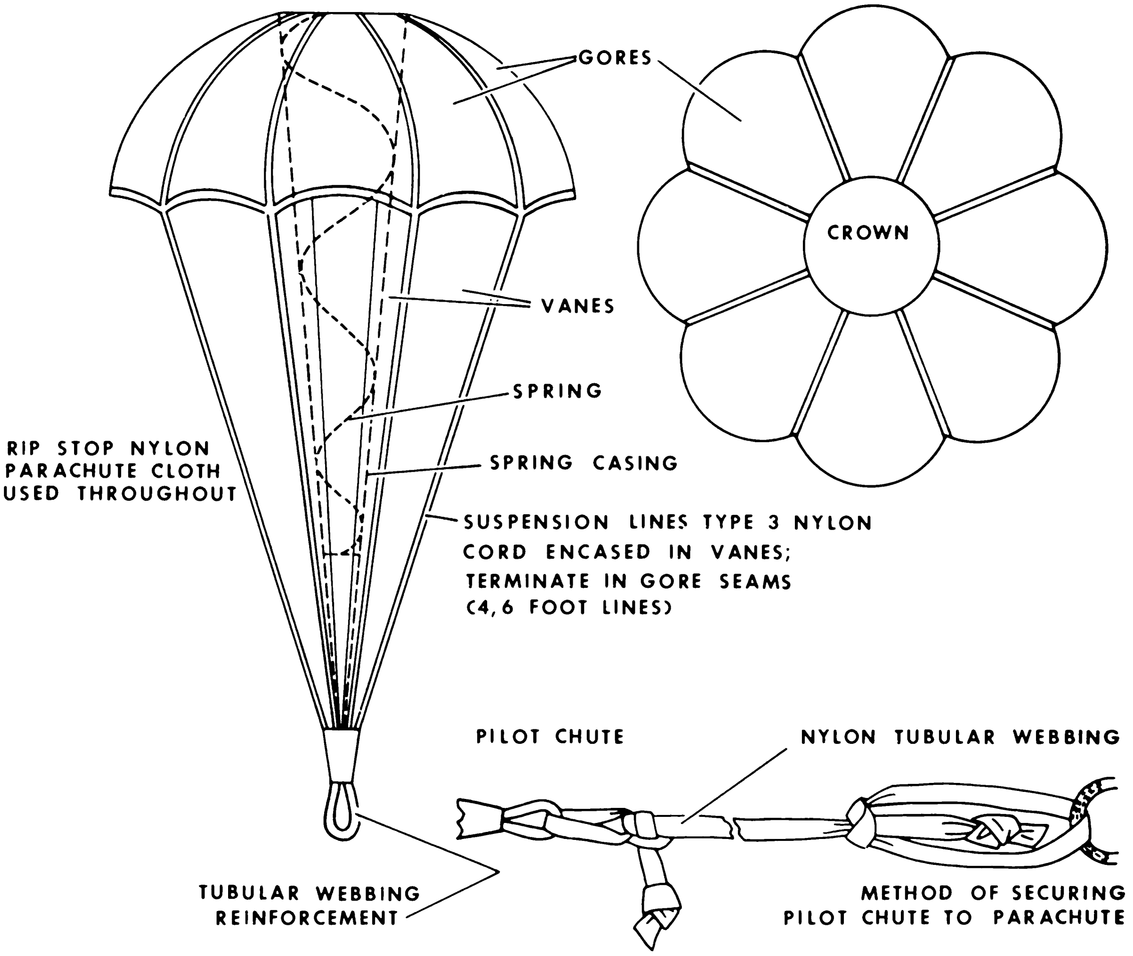

GORES
CROWN
VANES
SPRING
SPRING CASING
RIP STOP NYLON PARACHUTE CLOTH USED THROUGHOUT
SUSPENSION LINES TYPE 3 NYLON CORD ENCASED IN VANES; TERMINATE IN GORE SEAMS (4,6 FOOT LINES)
PILOT CHUTE
NYLON TUBULAR WEBBING
TUBULAR WEBBING REINFORCEMENT
METHOD OF SECURING PILOT CHUTE TO PARACHUTE

Figure 2-13.—The vane type pilot chute.

Stenciled on the diametrically opposite gore (section A of gore number 14) is found the following:

DATE OF MANUFACTURE AND SERIAL NO.

8. All marking fluid used should be in accordance with Specification MIL-I-6903A, amendment #1.

9. All machine stitching, except zigzag, should conform to Type 301, Federal Standard 751, and should be not less than 8 nor more than 11 stitches per inch.

10. Ends of all tape, webbing, and lines must be seared to prevent fraying. No waxes should be used.

11. For sewing diagonal seams, either size B or E nylon thread may be used. Use size E thread for all other seams, zigzag stitching, and repairs.

12. Removable connector links provide quick attachment of the canopy and suspensio lines to the harness.

Conical Canopy

Figure 2-16 illustrates the conical canop designed (like the 28-foot canopy) to absor opening shocks in excess of 8,000 pounds. parachute rigged with this canopy is reduce in bulk, and offers greater stability and faster opening. It has a slightly higher averag rate of descent (22 feet per second) than t 28-foot canopy.

Note the following construction difference

1. Shape.

2. Suspension lines are anchored to t canopy at the skirt and are not continuous fro

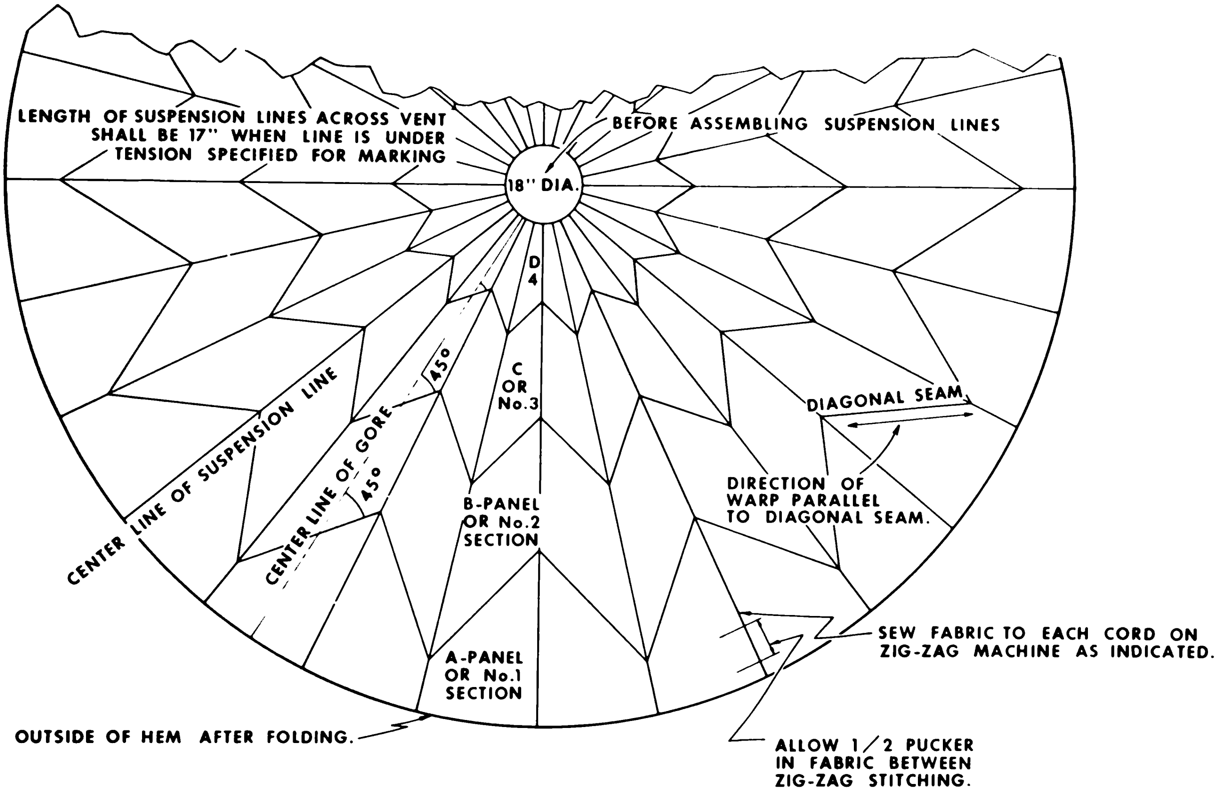

LENGTH OF SUSPENSION LINES ACROSS VENT SHALL BE 17" WHEN LINE IS UNDER TENSION SPECIFIED FOR MARKING
BEFORE ASSEMBLING SUSPENSION LINES
18" DIA.
D 4
C OR No.3
45°
CENTER LINE OF SUSPENSION LINE
CENTER LINE OF GORE
45°
DIAGONAL SEAM
DIRECTION OF WARP PARALLEL TO DIAGONAL SEAM.
B-PANEL OR No.2 SECTION
A-PANEL OR No.1 SECTION
SEW FABRIC TO EACH CORD ON ZIG-ZAG MACHINE AS INDICATED.
OUTSIDE OF HEM AFTER FOLDING.
ALLOW 1/2 PUCKER IN FABRIC BETWEEN ZIG-ZAG STITCHING.

Figure 2-14.—The 28-foot ripstop canopy.

nk to link. This reduces the bulkiness of the arachute.

3. Reinforcing bands of tape are located round the circumference starting at the top f section number 2.

4. The conical canopy does not have a vent ollar, but does have a vent cover.

5. There are 22 gores, the joining of which equires fewer seams and is less bulky.

6. The rate of descent has been sacrificed a certain degree in order to increase the trength and stability of the parachute.

SUSPENSION LINES

The suspension lines form a net or skeleton r the canopy and absorb much of the shock ad. They must therefore be placed under a 0-pound tension, marked, and cut as a group assure equal distribution of the shock load. he 28 suspension lines counted at the links are tually 14 lines, 75 feet 4 inches in length. hese lines run continuously from link to link; that is, each line is secured to a connector link on one side of the canopy, runs up and over the canopy, and down to a link on the opposite side.

Type III nylon suspension line is used on all main canopies and vane type pilot chutes. This line consists of a loosely woven outer covering called a sleeve, and several strong inner cords called the core. This core provides the greater portion of the strength of the suspension line.

Figure 2-17 illustrates the arrangement of the suspension lines on both the 28-foot and the 26-foot canopies. On the 28-foot canopy the lines are arranged in four groups of 7 lines each, while on the 26-foot canopy they are arranged in two groups of 5 and 2 of 6 lines each.

The suspension lines are attached to the connector links by tying a clove hitch, a half-hitch, and completing the attachment with 2 inches of zigzag stitching. This attachment is shown in figure 2-18.

To prevent the canopy on the 28-foot parachute from slipping along the suspension lines, each line is anchored by zigzag stitching at

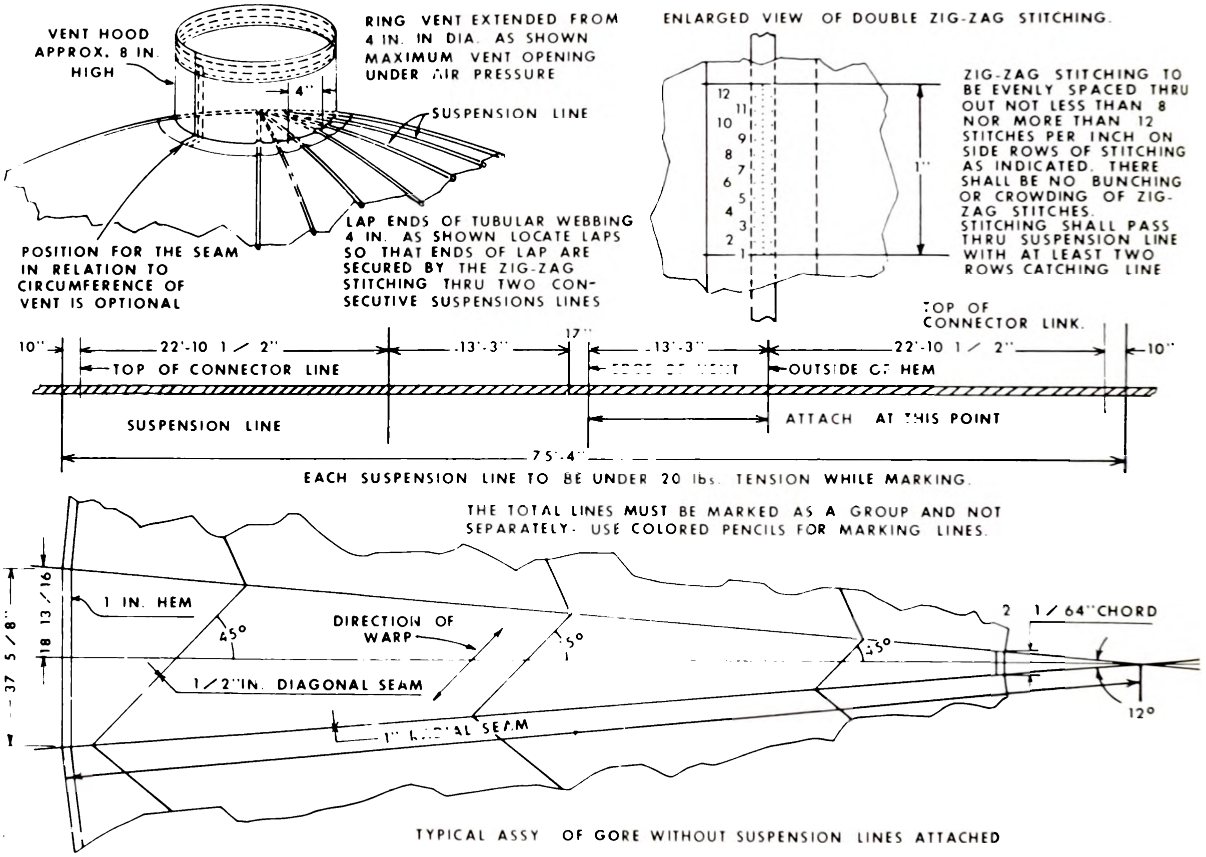

VENT HOOD APPROX. 8 IN. HIGH
4"
RING VENT EXTENDED FROM 4 IN. IN DIA. AS SHOWN MAXIMUM VENT OPENING UNDER AIR PRESSURE
SUSPENSION LINE
POSITION FOR THE SEAM IN RELATION TO CIRCUMFERENCE OF VENT IS OPTIONAL
LAP ENDS OF TUBULAR WEBBING 4 IN. AS SHOWN LOCATE LAPS SO THAT ENDS OF LAP ARE SECURED BY THE ZIG-ZAG STITCHING THRU TWO CONSECUTIVE SUSPENSIONS LINES
ENLARGED VIEW OF DOUBLE ZIG-ZAG STITCHING.
12
11
10
9
8
7
6
5
4
3
2
1
1"
ZIG-ZAG STITCHING TO BE EVENLY SPACED THRU OUT NOT LESS THAN 8 NOR MORE THAN 12 STITCHES PER INCH ON SIDE ROWS OF STITCHING AS INDICATED. THERE SHALL BE NO BUNCHING OR CROWDING OF ZIG-ZAG STITCHES. STITCHING SHALL PASS THRU SUSPENSION LINE WITH AT LEAST TWO ROWS CATCHING LINE
TOP OF CONNECTOR LINK.
10"
22'-10 1/2"
13'-3"
17"
13'-3"
22'-10 1/2"
10"
TOP OF CONNECTOR LINE
EDGE OF VENT
OUTSIDE OF HEM
SUSPENSION LINE
ATTACH AT THIS POINT
75'-4"
EACH SUSPENSION LINE TO BE UNDER 20 lbs. TENSION WHILE MARKING.
THE TOTAL LINES MUST BE MARKED AS A GROUP AND NOT SEPARATELY. USE COLORED PENCILS FOR MARKING LINES.
37 5/8"
18 13/16"
1 IN. HEM
45°
DIRECTION OF WARP
45°
45°
1/2" IN. DIAGONAL SEAM
1" RADIAL SEAM
2 1/64" CHORD
12°
TYPICAL ASSY OF GORE WITHOUT SUSPENSION LINES ATTACHED

Figure 2-15.—The 28-foot ripstop canopy—Continued.

several points to the radial seams through which it passes. One-half inch of slack is allowed in the vicinity of the skirt between the zigzag sewing points to relieve the strain during opening shock.

PARACHUTE HARNESS

Parachute harnesses are designed to secure the parachute to the wearer and provide support during opening shock and descent. The harnesses currently being used by the Navy are the quick fit (so called because of the ease and speed with which they may be adjusted by the wearer) and the integrated torso harness.

The integrated torso harness combines parachute harness, lap belt, and shoulder harness into one integrated garment which improves comfort, mobility, and retention, and is easier to don and remove. It also reduces the number of exposed straps and overall bulk and weigh This harness is discussed in detail in chapter 1

The parts of the parachute harness which tak the load during a descent are nylon webbing a soft weave, conforming to Specification MIL W-4088D, and metal fittings of alloy steel whic are proof loaded in accordance with applicabl standard drawings.

The standard quick-fit harness is made three configurations—seat type, back type, a chest type. The seat and back types are the sam in design construction except that the seat typ requires lift webs of greater length to com pensate for the difference in the location of th packs. The main parts of these harnesses a the combined main suspension sling and li webs, leg straps, horizontal backstrap, diagon backstrap (or cross shoulder strap), and ches straps. (See fig. 2-19.)

The principal difference between the ches type and the seat or back type harness is th

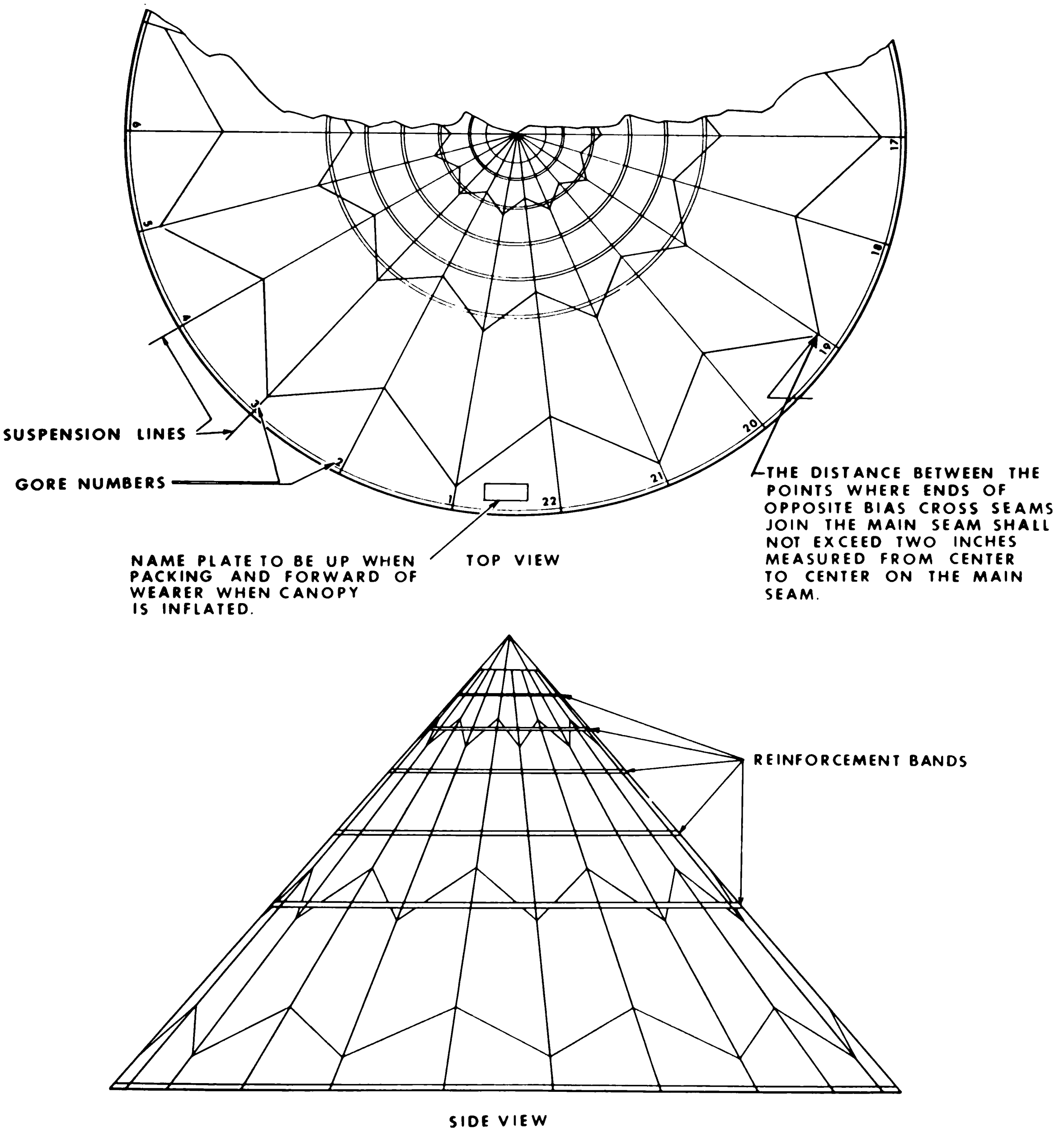

6
5
4
3
2
1
22
21
20
19
18
17
SUSPENSION LINES
GORE NUMBERS
NAME PLATE TO BE UP WHEN PACKING AND FORWARD OF WEARER WHEN CANOPY IS INFLATED.
TOP VIEW
THE DISTANCE BETWEEN THE POINTS WHERE ENDS OF OPPOSITE BIAS CROSS SEAMS JOIN THE MAIN SEAM SHALL NOT EXCEED TWO INCHES MEASURED FROM CENTER TO CENTER ON THE MAIN SEAM.
REINFORCEMENT BANDS
SIDE VIEW

Figure 2-16.—Conical canopy, 26-foot, 22-gore.

e lift webs separate from the main suspension ing at a point near the chest on each side of body. This is accomplished by the incorpora-n of two D-rings in the harness sling and two nnector snaps in a separate lift web assembly.

The lift web assembly consists of two equal gth straps each laced through the webbing slot of a connector snap. The connector snap is located at the middle of each strap, which is folded back and sewn together just above the snap. The loose ends of each are sewn to individual links connecting to the canopy. Two connector snaps are joined by a cross-connector strap which prevents collapse of the canopy in the

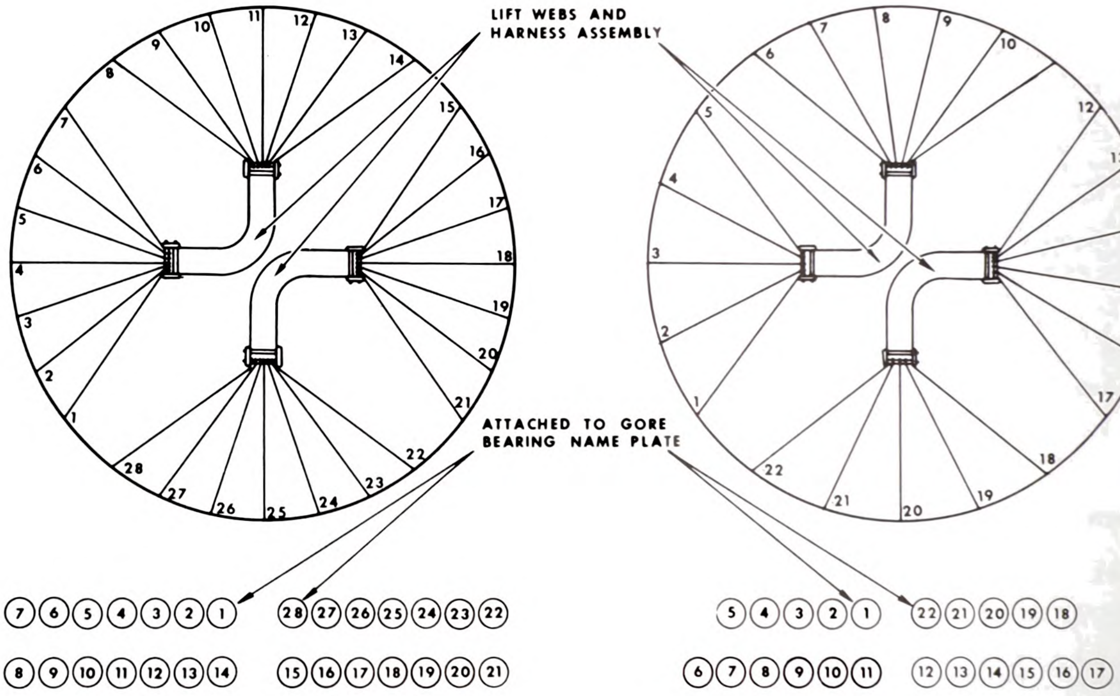


Figure 2-17.—Suspension line arrangement.

event that only one snap is attached to the harness D-ring. The lift web is tacked to the pack with cord which breaks when the canopy inflates and allows the pack to break away. The chest type harness and the lift web assembly are illustrated in figure 2-20.

The date of manufacture (month and year) should be stamped with marking fluid conforming to Specification MIL-I-6903A, amendment 1, in letters 1/2 inch high on either the inside of the horizontal backstrap or on the inside of the sling. All exposed ends of webbing should be seared to prevent fraying; and unless otherwise specified, all machine stitching is to be 6-cord sage green nylon thread with not less than 4 nor more than 6 stitches per inch. Ends of all stitching should be backstitched a distance of not less than 1/2 inch.

PARACHUTE CONTAINER

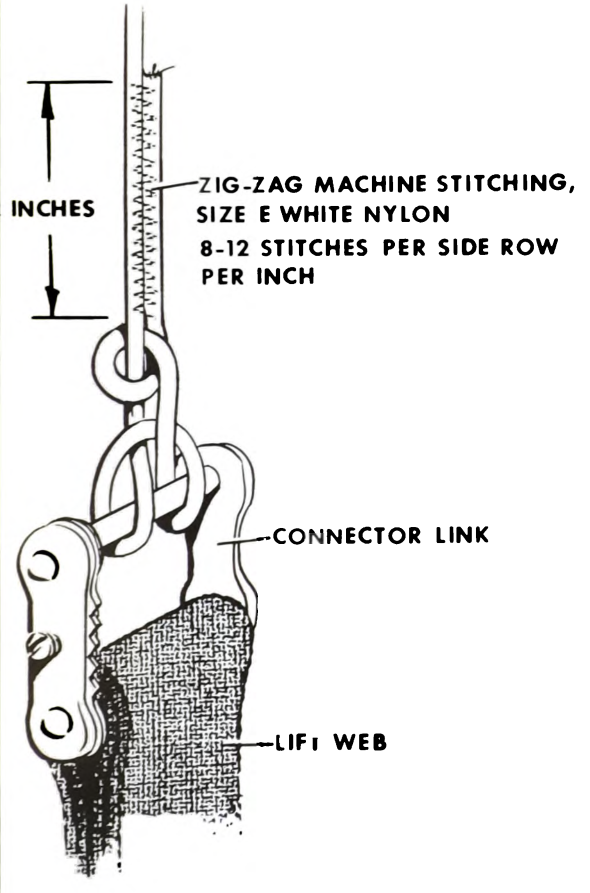
The parachute container is designed to house and protect the pilot chute, main canopy, and suspension lines. It is made of type III nylon fabric, conforming to Specification MIL-C-7219B, amendment 1. The outside covering is cut in one piece on the bias. This is necessar to provide adequate elasticity for the pack. Th machine stitching on the container is made wit type E nylon thread, 6 to 8 stitches to the inch

Figures 2-21 through 2-23 illustrate the thre general types of containers used with the standard service type parachutes.

Additional information on the materials used in this work may be found in BuWeps and Ai Force publications, along with Military an Federal Specifications. Frequent reference t these publications is necessary to keep you technical knowledge up to date.

RIPCORDS

The ripcord is a manual releasing device used to release the canopy from the container It consists of locking pins securely attache to a length of 3/32-inch diameter corrosion resistant steel cable. The ripcord handles ar made of steel tubing in the shape of a cloverlea or a trapezoid, and are attached by passin the cable through a small hole drilled in th grip and then swaging a retaining ball or clampin a small sleeve onto the loose end of the cable


INCHES
ZIG-ZAG MACHINE STITCHING, SIZE E WHITE NYLON
8-12 STITCHES PER SIDE ROW PER INCH
CONNECTOR LINK
LIFT WEB

'igure 2-18.—Method of attaching suspension lines at the link.

ne pins are swaged in place and tested to thstand a pull of 300 pounds.

An extensible ripcord is shown in figure 24. This type is used with the seat type paraute and makes changing to or from the pararaft sier by eliminating the need of changing to nger or shorter ripcords.

PCORD HOUSING

The ripcord housing consists of a flexible eel tube affixed to the parachute container one end and to the main sling on the left le of the harness at the other. It is provided house the ripcord cable and prevent accidental ening of the parachute. The housing is secured the harness and container in such a manner to permit the parachute assembly to be improperly lifted by the housing without withdrawing the ripcord locking pins from the locking cones on the parachute container.

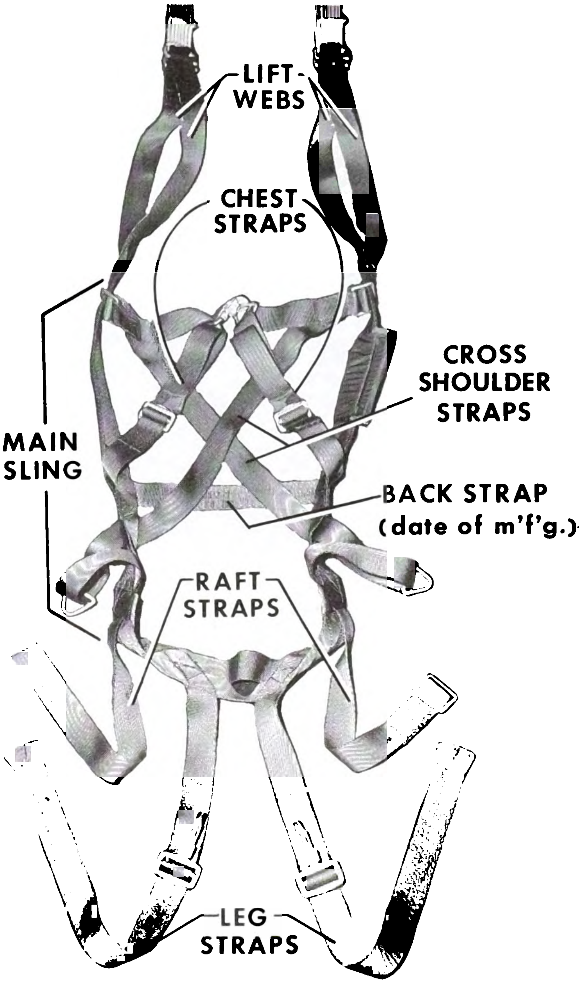


Figure 2-19.—Back type quick-fit parachute harness.

RIPCORD GRIP POCKET

The ripcord grip pocket is made of type III nylon fabric conforming to Specification MIL-C-7219B, amendment 1. It is designed to retain the ripcord grip under normal circumstances and still provide ease in removal when the ripcord is properly pulled.

SEAT CUSHIONS AND BACK PADS

Some of the older type parachutes still use seat cushions and back pads. These cushions

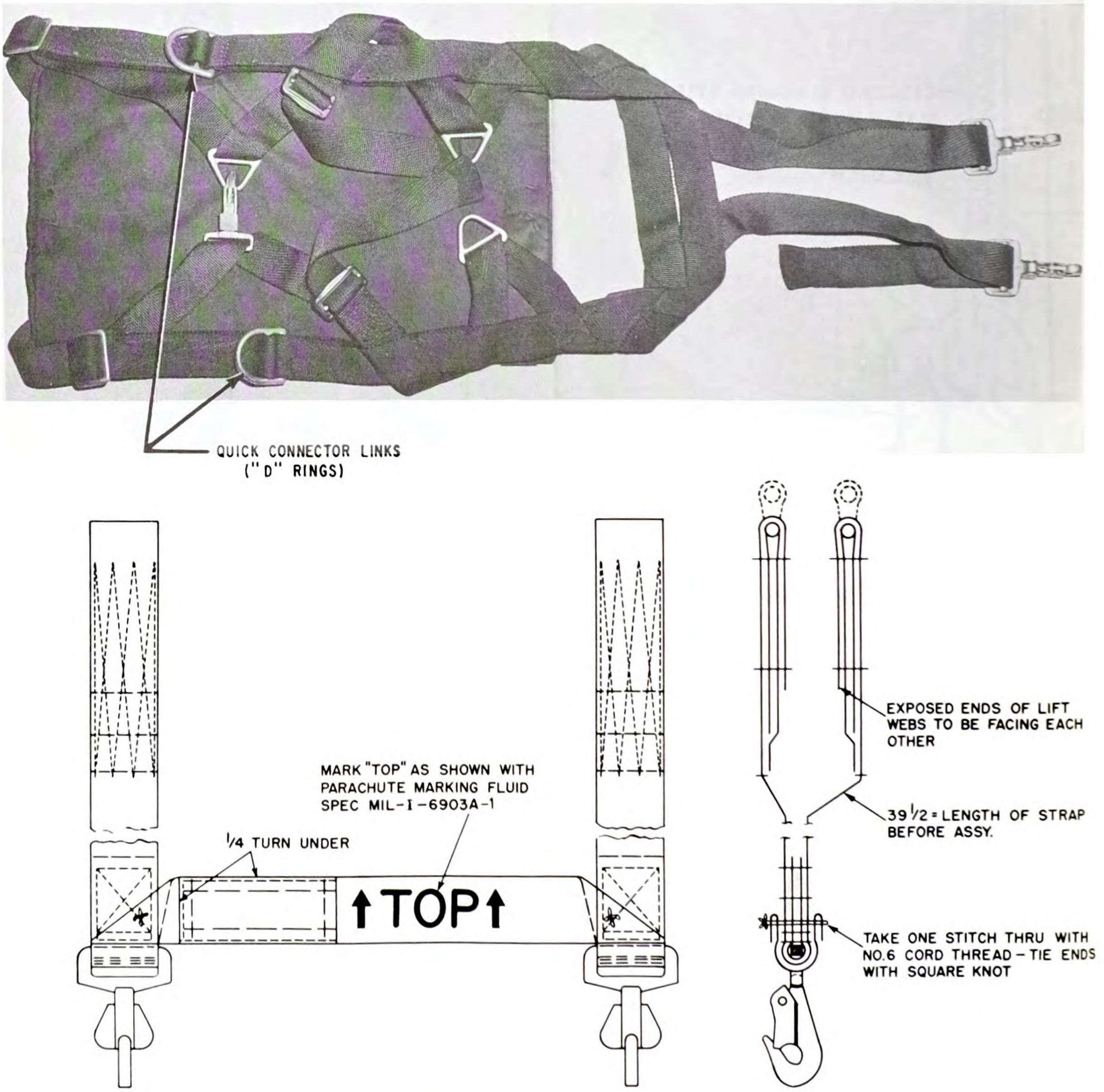

QUICK CONNECTOR LINKS ("D" RINGS)
MARK "TOP" AS SHOWN WITH PARACHUTE MARKING FLUID SPEC MIL-I-6903A-1
1/4 TURN UNDER
↑TOP↑
EXPOSED ENDS OF LIFT WEBS TO BE FACING EACH OTHER
39 1/2 = LENGTH OF STRAP BEFORE ASSY.
TAKE ONE STITCH THRU WITH NO.6 CORD THREAD - TIE ENDS WITH SQUARE KNOT

Figure 2-20.—Chest type harness and lift web assembly.

and pads are made of foam rubber covered with canvas and are designed to provide comfort to the wearer when attached properly between the parachute harness and the wearer.

As shown in figure 2-25, the cushion is a part of the survival kit when used with the NB-7E in the A-5 (A3J) type aircraft. This cushion is made of a sponge type polyurethane pad and bonded to the contoured surface on top of tl upper half of the container. The parachute ai upper half of the container are secured togeth by zipper flaps at the lower end of the par chute and at the aft end of the container upp half.

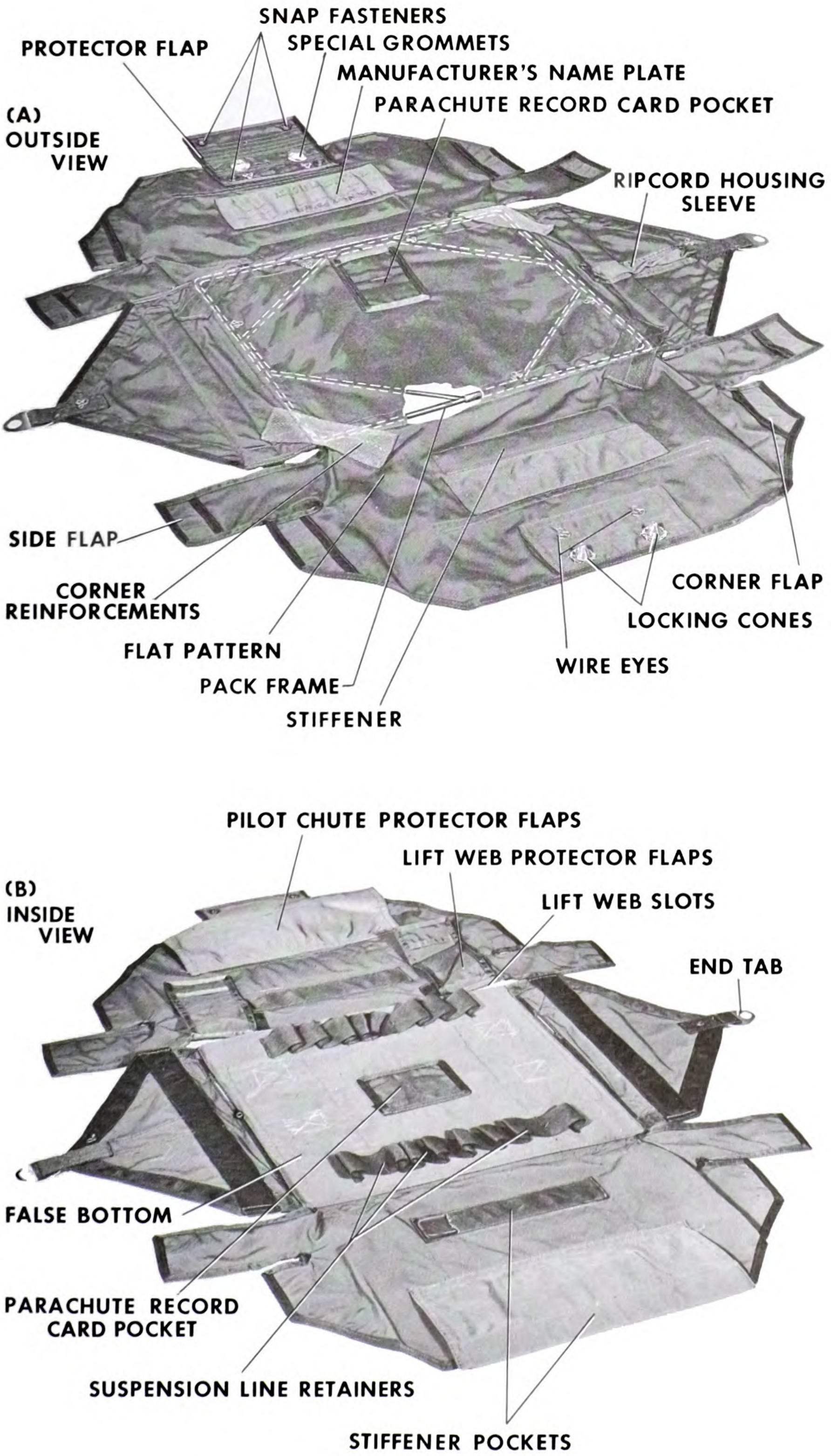
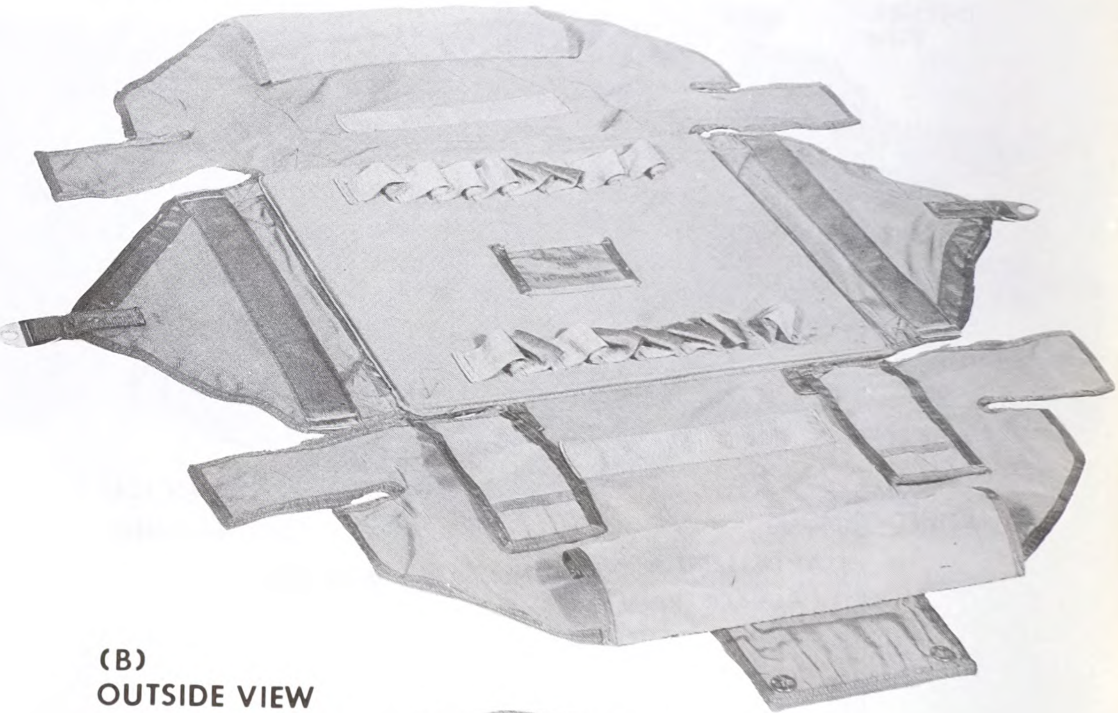


Figure 2-21.—Seat type container.

(A)
INSIDE VIEW



(B)
OUTSIDE VIEW

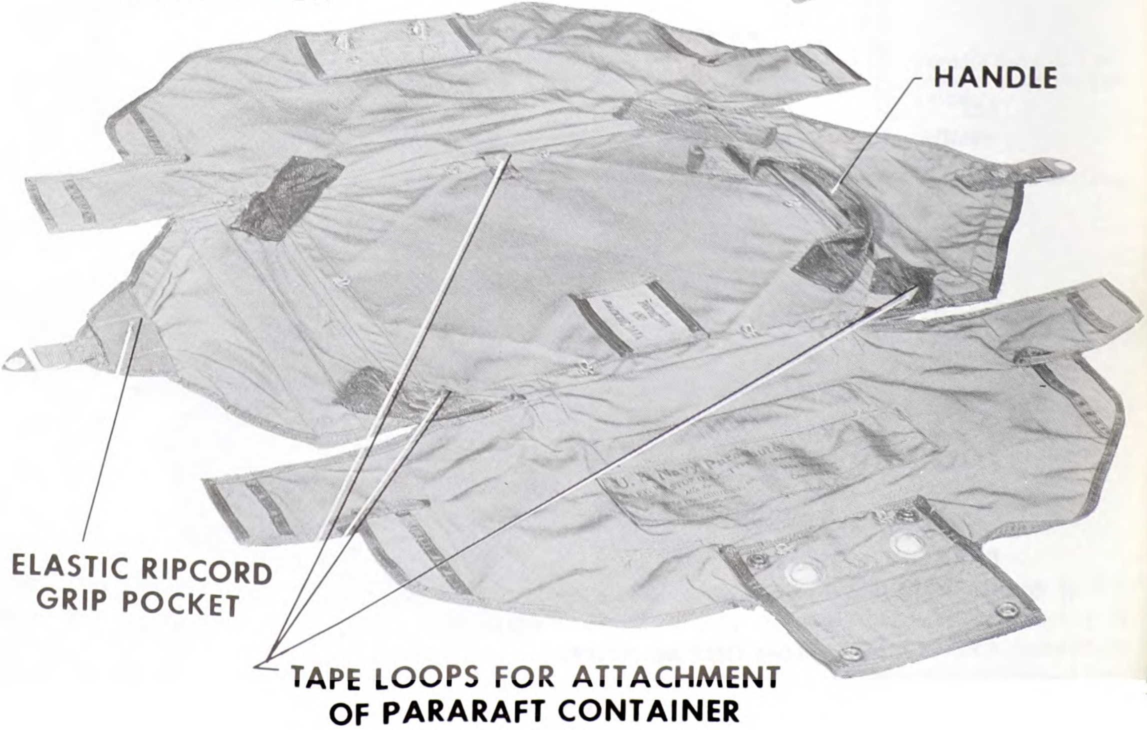
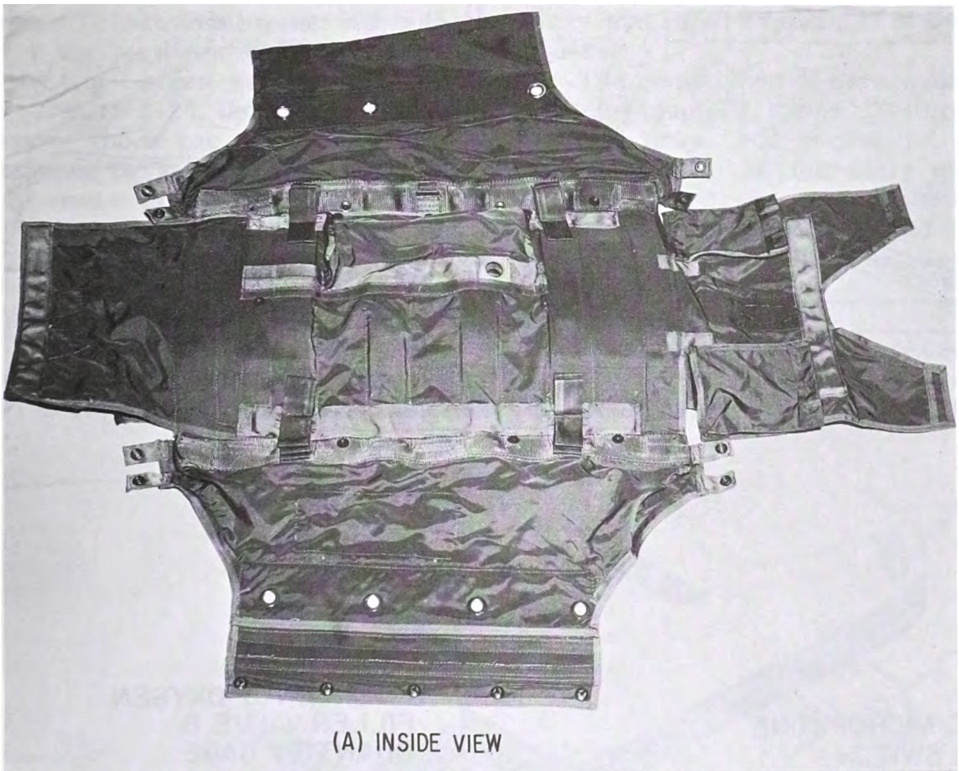
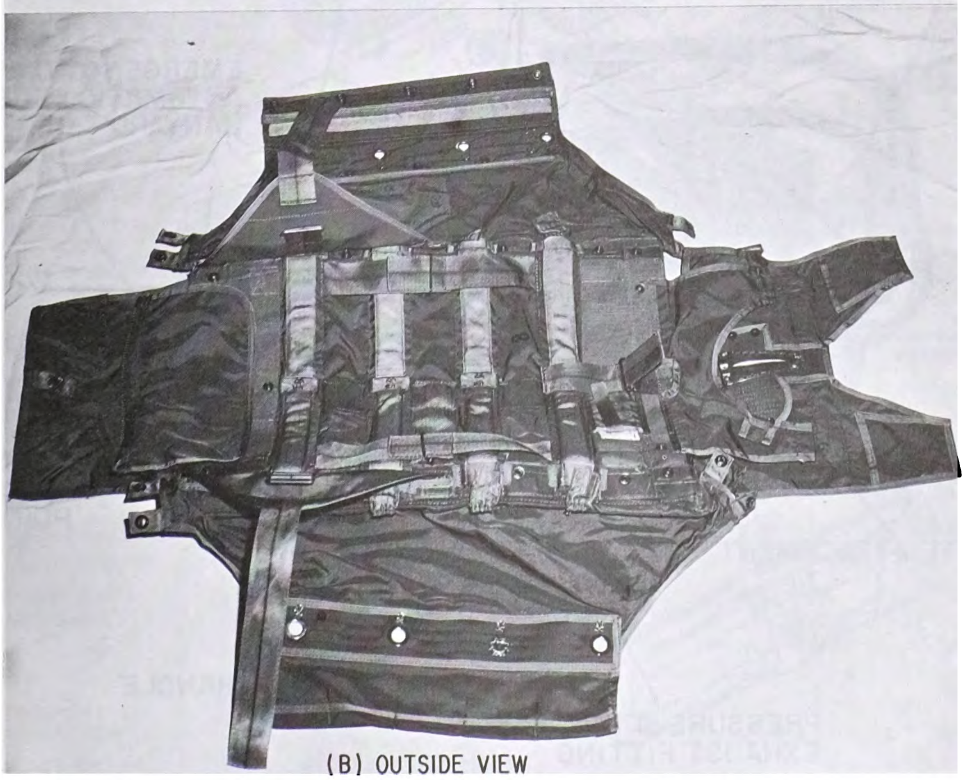

HANDLE
ELASTIC RIPCORD GRIP POCKET
TAPE LOOPS FOR ATTACHMENT OF PARARAFT CONTAINER

Figure 2-22.—Chest type container.



(A) INSIDE VIEW



(B) OUTSIDE VIEW

Figure 2-23.—Back type container.

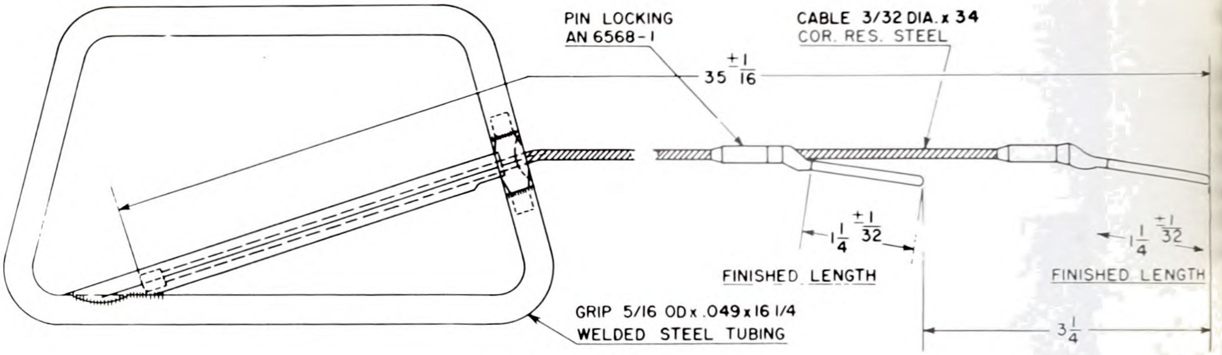


Figure 2-24.—Extensible ripcord.

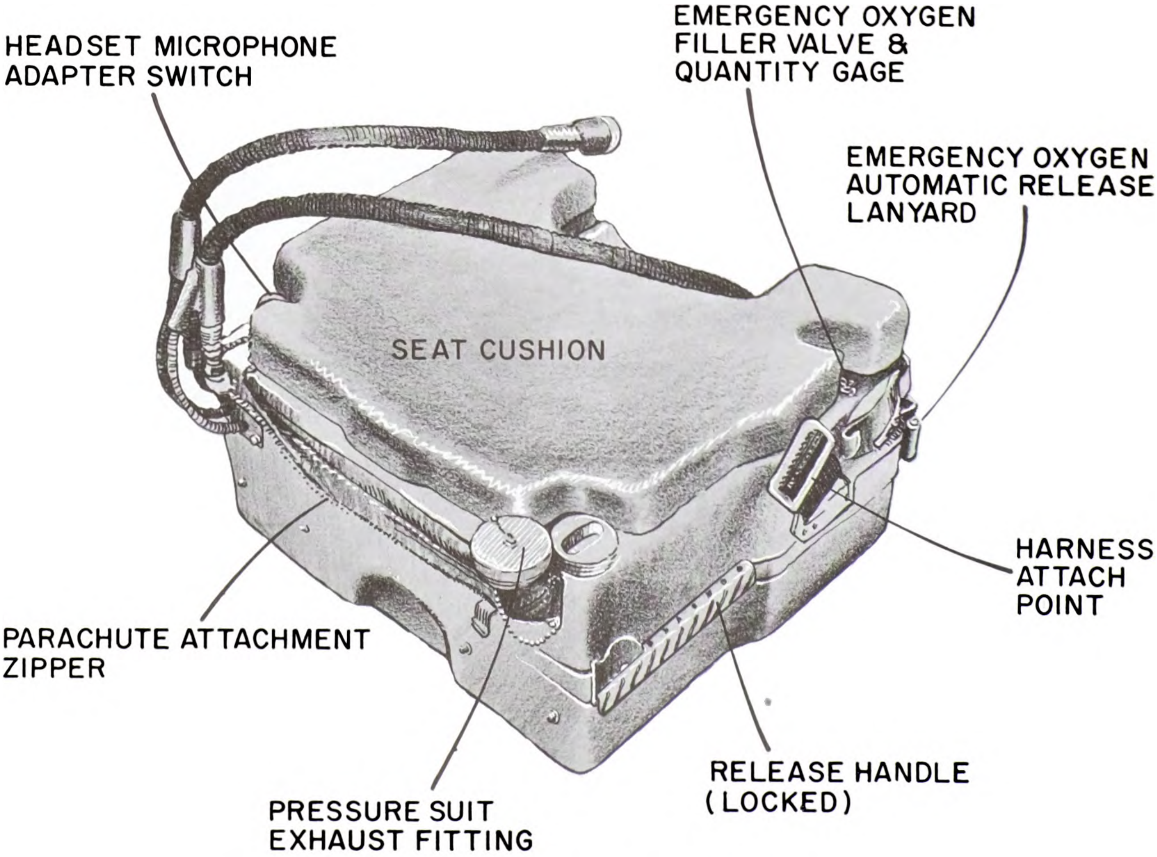


Figure 2-25.—Survival kit container.

The NB-9 parachute, as used in the A-4 4D) type aircraft, uses the seat pan assembly a cushion. This assembly serves both as cushion for the pilot and a container for the ergency bailout oxygen supply cylinder. As ustrated in figure 2-26, the seat pan consists a metal pan, shock pad, foam comfort pad, -inch U-shaped oxygen cylinder, and a cover ich is zippered over the complete assembly. e pararaft kit is attached to the bottom of the at pan and both are fitted into the seat bucket.

PARACHUTE HARNESS HARDWARE

Parachute harness fittings (hardware) are all metal devices usually made of cadmium or chrome-plated steel. They are designed to join the parachute pack and harness and to afford easy and rapid adjustment of the harness to the wearer.

The many types of parachute harness fittings include adapters, snaps, D-rings, V-rings, connector links, and rocket jet canopy release fittings. Some of the more common types of these fittings and their tensile strengths are illustrated in figures 2-27 and 2-28.

ADAPTERS

Two types of adapters are used with a regular quick-fit type harness. They are the regular harness adjuster adapter and the friction adapter.

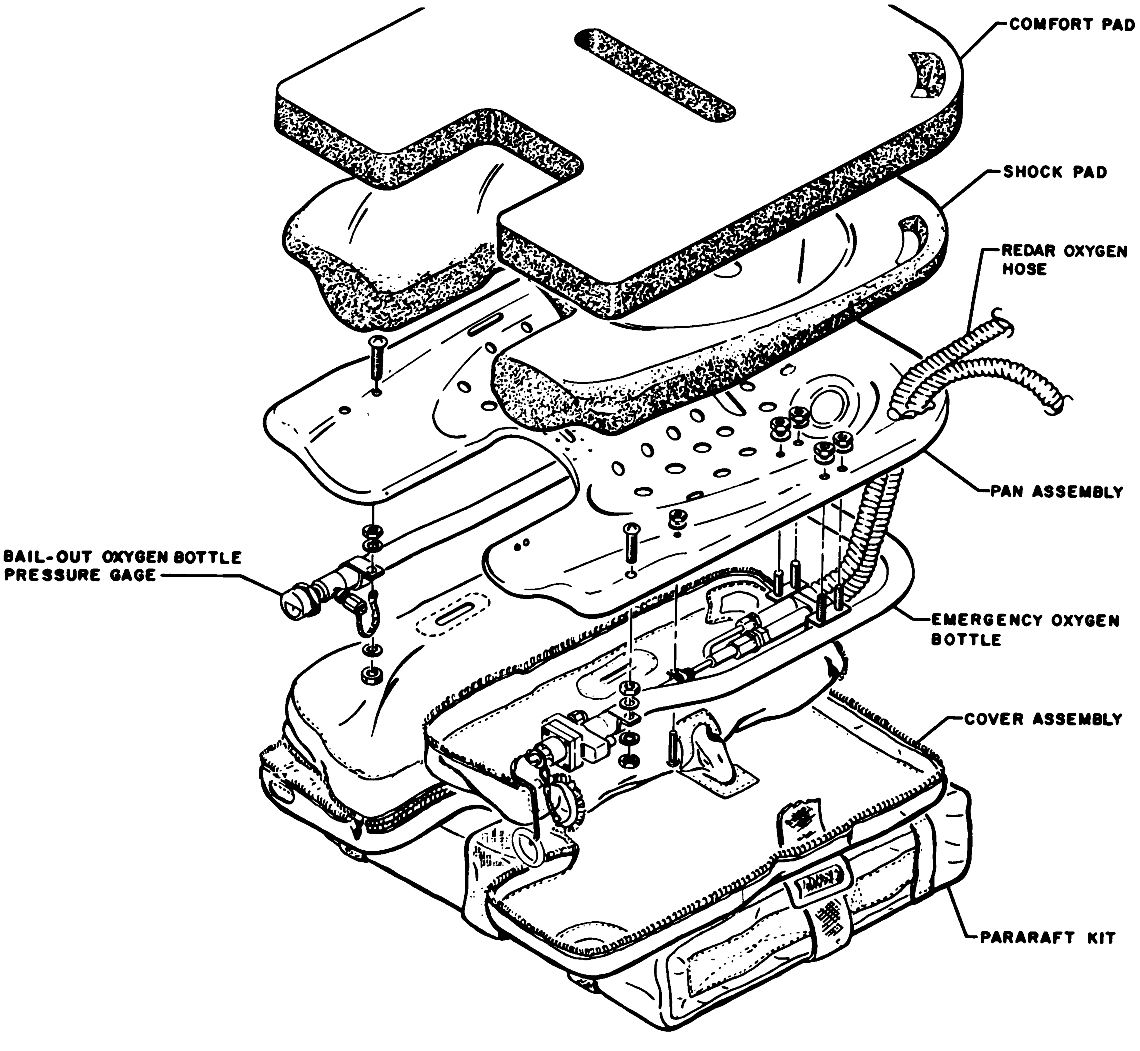


Figure 2-26.—Seat pan assembly.

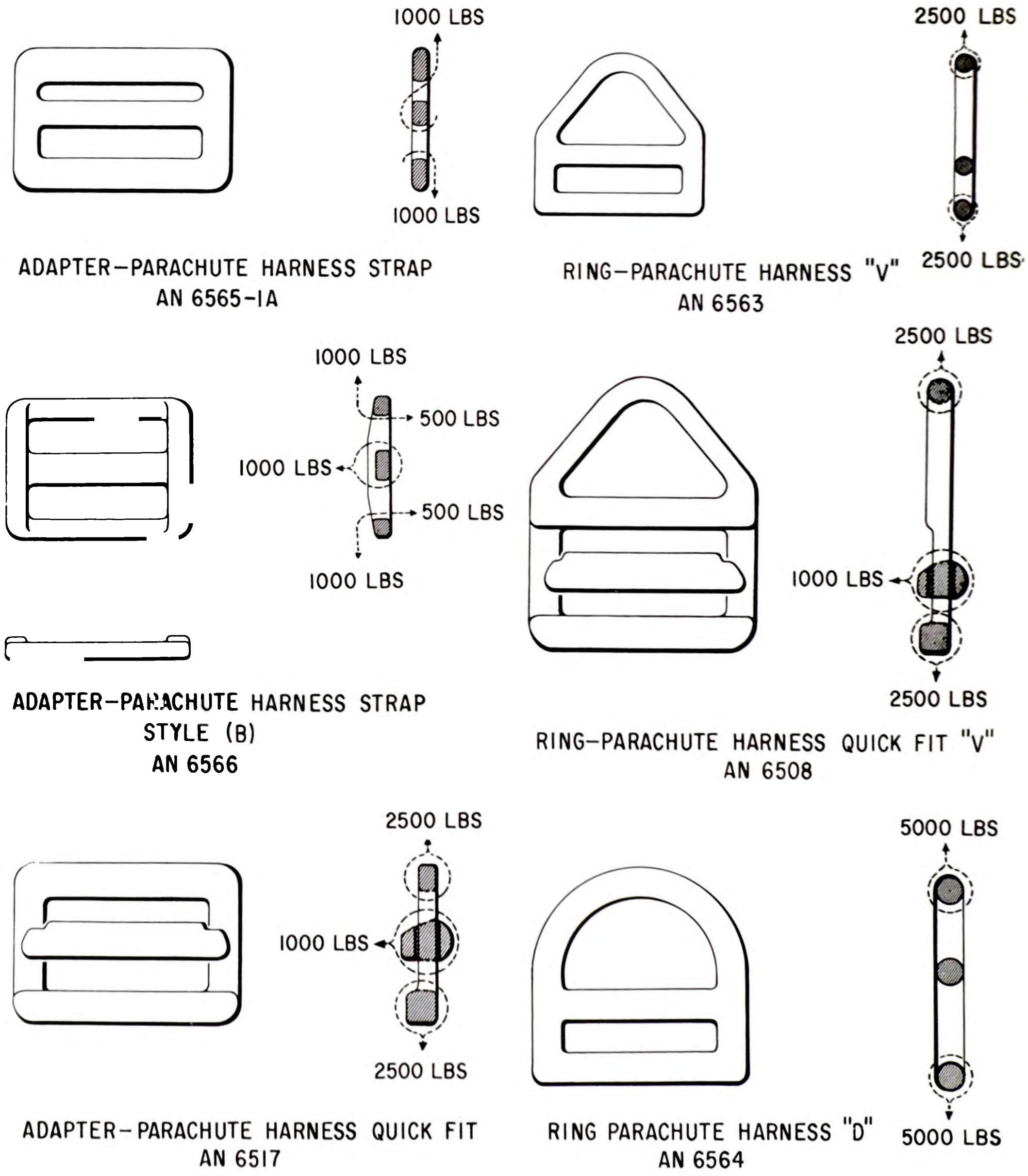
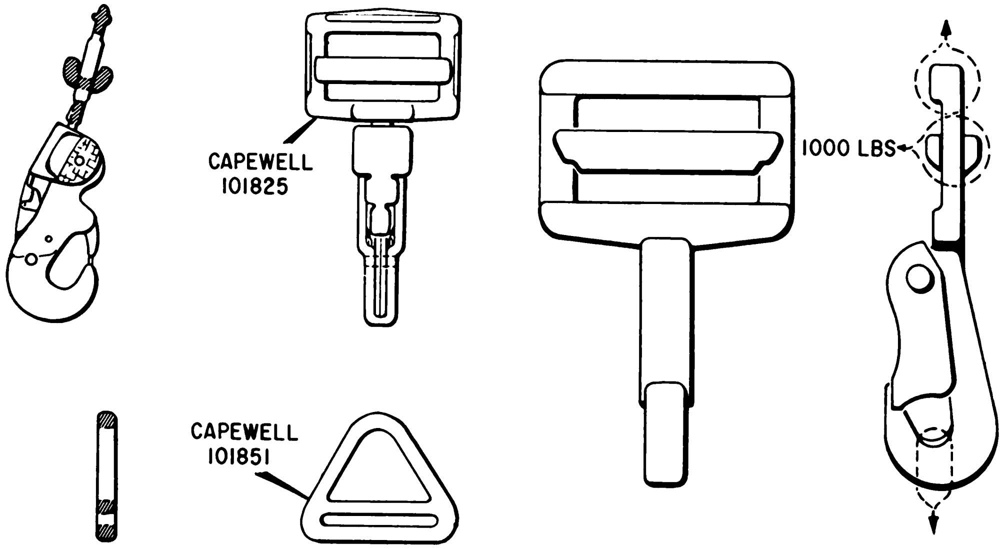


Figure 2-27.—Parachute harness hardware.

The harness adapter is used to adjust the harness to the wearer and the quick-fit adapter has a grip slide bar which facilitates quick adjustment of the harness by the wearer.

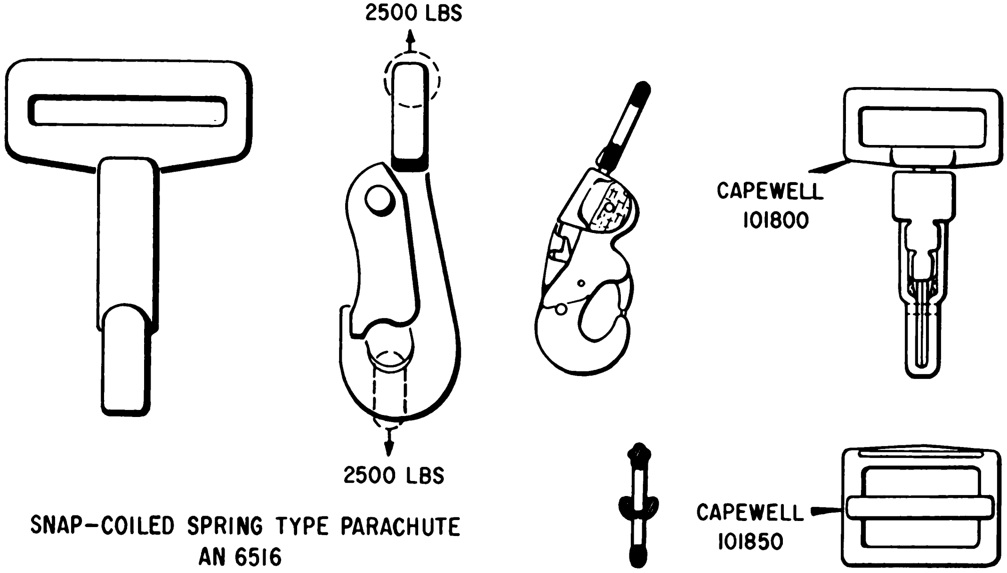
SNAPS

There are several types of snaps in use with parachutes. They are the plain harness snap, the quick-fit snap, and the quick connector sna The harness snap is a plain hook-shaped, sprin actuated guard, which snaps over a V-ring secure two parts of the harness together. Th quick-fit snap is similar except that it has grip slide bar. The quick connector snap similar to the harness snap and is used as means to quickly attach the Navy chest typ parachute to the two D-rings on the Navy che type harness.



LINK-TRIANGLE

SNAP-PARACHUTE HARNESS QUICK FIT
AN 6509



SNAP-COILED SPRING TYPE PARACHUTE
AN 6516

Figure 2-28.—Parachute harness hardware—Continued.

ONNECTOR LINKS

Connector links are fittings designed to join e parachute to the harness. The suspension nes are attached to one side and the harness the other.

OCKET JET CANOPY RELEASE

Integrated torso harnesses are equipped ith four connector links (D-rings) which attach to the rocket jet canopy release fittings on the integrated parachute. (See fig. 2-29.) The fittings on the parachute riser/shoulder restraint harness straps attach to the D-rings located on each side of the upper chest. The two rocket jet fittings on the aircraft lap belt attach to the D-rings located on the lower front panel. Figure 2-30 shows the attachment of the fittings to the integrated torso harness.

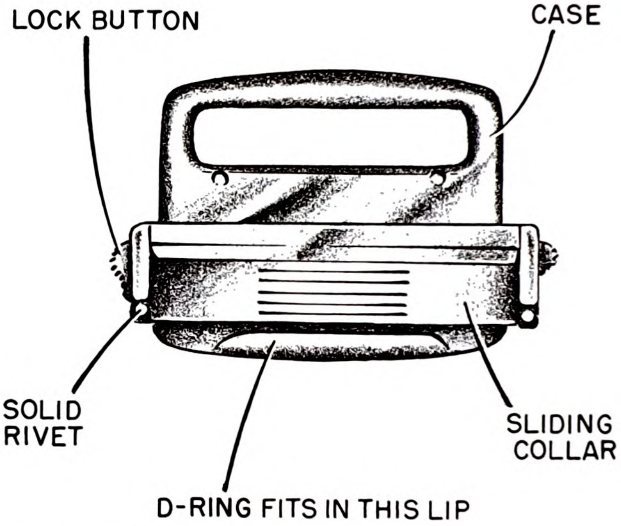


Figure 2-29.—Rocket jet canopy release.

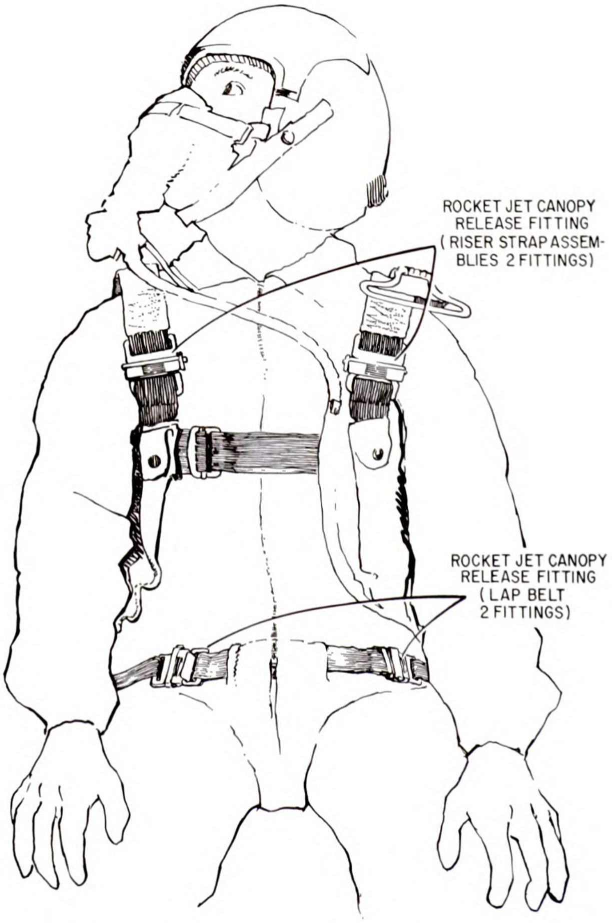

ROCKET JET CANOPY RELEASE FITTING (RISER STRAP ASSEMBLIES 2 FITTINGS)
ROCKET JET CANOPY RELEASE FITTING (LAP BELT 2 FITTINGS)

Figure 2-30.—Rocket jet fittings on integrated harness.

CHAPTER 3

PARACHUTE INSPECTION

Parachutes are designed to provide an avenue
escape for pilots and aircrewmen from dis-
ed aircraft. The nature of this lifesaving item
ves no margin for error in the work of the
rachute Rigger. The parachute must be ready
render prompt, efficient, and reliable service
all times.

Parachute inspections must be carefully con-
cted, insuring comfort, security, rapid posi-
e functioning, and air worthiness of the entire
sembly.

FACTORS AFFECTING MALFUNCTIONS

Before inspecting a parachute, the Parachute
gger must know what to look for. Some of the
tors which might cause a malfunction are dis-
ssed in the following paragraphs.

EAR

Wear in a parachute is not difficult to detect.
is indicated by chafing at corners or on the
side surfaces where the most frequent con-
t with moving objects is encountered.

Parts of parachutes and related equipment
owing excessive wear should be replaced when
replacement involves a minor repair. If the
placement or repair is a major repair, the
rachute must be sent to a major overhaul
tion.

NOTE: Disposition of major and minor re-
irs is discussed later in this chapter.

AINS

Stains appear as a discoloration or blemish
the material. Although not all stains are harm-
to nylon they should be considered as harmful
ents until identified and proven harmless.
ose caused by contact with acid, oil, and salt
ter are the most harmful to nylon and should be removed as quickly as possible to prevent further deterioration of the material. Parachute Riggers must learn to recognize these stains quickly and know the best method of removing or remedying each.

SUSPENSION LINES OUT OF POSITION

Be sure that each of the suspension lines is in proper rotation at the links and through the canopy. Insure that each unit of the assembly is in its correct position.

NONCOMPLIANCE WITH CURRENT DIRECTIVES

Check all modifications to the parachute and its component assemblies for the latest changes in accordance with current BuWeps Aviation Clothing and Survival Equipment Bulletins. Do not permit any local modifications without prior approval of proper authority.

INCOMPLETENESS

It is the Parachute Rigger's responsibility to insure that the parachute is complete and ready for service in every respect when issued from the loft. It is therefore necessary to check the entire assembly for completeness at each inspection. It is always possible that the omission of an item, regardless of how small or seemingly insignificant, will affect the operation of the parachute.

MANUFACTURER'S ERRORS

When inspecting a new parachute, be especially watchful for errors in the material and workmanship. It is very easy for a mistake to get by in a large plant where many persons are involved in completing a single product. Newness is not necessarily an indication that an object is perfect or even in good condition. Always make a thorough inspection of every part of a new parachute before it is packed for service use.

FLAWS

Small flaws which are occasionally found in fabric may not seriously affect the strength or operation of the parachute. However, when a flaw is found in the canopy or in a suspension line and there is any doubt as to proper disposition, the best rule to follow is to send the parachute to a major overhaul station for inspection and/or repair.

INSPECTION INTERVALS

Parachutes in service are normally inspected daily, at 10-day intervals, and at 60-day intervals. In the tropic zones these intervals may be shortened, depending upon local conditions. These inspection intervals have been set up in order to insure that the parachute will give years of efficient reliable service.

DAILY INSPECTION

All parachutes in service use are given a sight inspection daily. This inspection is to check for acid stains, or other damage which might have occurred during its transportation to and from the aircraft or while in use.

10-DAY INSPECTION

Parachutes in service use must be given a thorough visual inspection once in each 10-day period by qualified loft personnel.

60-DAY INSPECTION

Once in each 60-day period all personnel parachutes in service use are opened, and each component part is given a complete and thorough inspection. The parachute is then hung in a suitable drying locker to air and dry for a period of 24 hours and repacked for service use. This period may be reduced in the interest of operational effectiveness with the approval of the commanding officer. After bailout or ejection, the parachute is turned in to supply and sent to El Centro.

TROPICAL INSPECTIONS

Tropical inspections are made exactly a the 60-day inspection, except that the interva between inspections is shortened as local conditions warrant.

NOTE: Complete inspection and dry locke procedure may be found in chapter 6 of th latest revision of NavWeps 13-5-501.

36-MONTH INSPECTION

All parachutes in storage (parachutes store in tin containers or cans for permanent storage must be shipped to the nearest overhaul activit for complete inspection, drying, and repackin in special containers after 36 months.

INSPECTION PROCEDURES

Changes to policy, inspection procedures and to the parachutes themselves require tha frequent reference be made to current BuWeps Aviation Clothing and Survival Equipment Bulletins. Parachutes will give many years of useful service if all inspections are performed properly, and a system of corrective maintenance i set up and adhered to.

10-DAY INSPECTION

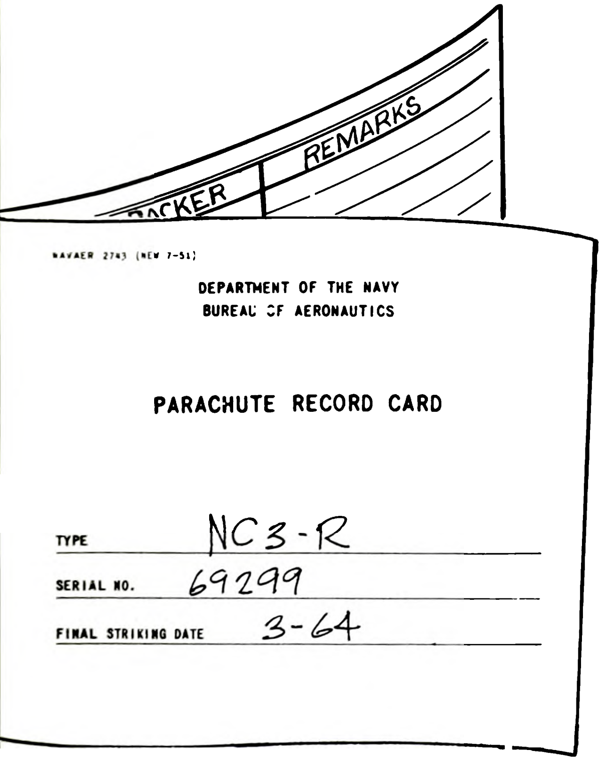
The 10-day inspection is performed by qualified Parachute Riggers as follows:

Examine the outside of the pack for wear stains, and dampness. Inspect the pack openin bands for general condition and security to th pack.

Test the ripcord handle to see that the cabl is properly attached and that the handle wil come out of the ripcord grip pocket. A loosel fitting ripcord grip can be very dangerous.

Look for wear, stains, and twists in the harness and examine the lift web tackings at th pack. Look also for damage or corrosion on th harness hardware. Check the cushions for damage and security of attachment.

The ripcord housing must be securely fastened to the harness and pack with the prope tackings. Examine the ripcord protector flap fo damage and proper security, and the lockin cones and grommets for burrs or other damage Check the ripcord pins for bends or breaks, an see that the safety tie is not broken. Sign th Parachute Record Card, NavWeps 2743. (Se fig. 3-1.)



CKER | REMARKS

NAVAER 2743 (NEW 7-51)

DEPARTMENT OF THE NAVY
BUREAU OF AERONAUTICS

PARACHUTE RECORD CARD

TYPE NC3-R

SERIAL NO. 69299

FINAL STRIKING DATE 3-64

Figure 3-1.—Parachute Record Card, NavWeps 2743.

-DAY INSPECTION

When making either the 60-day or the tropical ispection, the procedure listed below should e followed.

Inspect all canopy and harness releases for racks and structural damage, such as deformaon of the collar or riser attachment bar. Make e operational check with a test setup as decribed in BuWeps Aviation Clothing and Surival Equipment Bulletin 50-61. Each canopy d harness release must be locked and unlocked 5 times without malfunction.

NOTE: Do not attempt to repair a release. the event of failure of a release to pass the perational test, it must be tagged as unserviceble and replaced.

anopy

Open the parachute by attaching a suitable pring type scale to the ripcord and pulling on e scale. Note the amount of pressure required remove the pins from the cones. This presure should not exceed 27 pounds.

Lay out the canopy on a packing table as shown in figure 3-2 with the nameplate uppermost. Starting with the gore bearing the name plate, proceed systematically up the gore inspecting each section for rips, tears, snags, stains, or other damage. Inspect each diagonal and radial seam for broken or otherwise usuitable stitches. Continue this method throughout the canopy until each gore has been completely

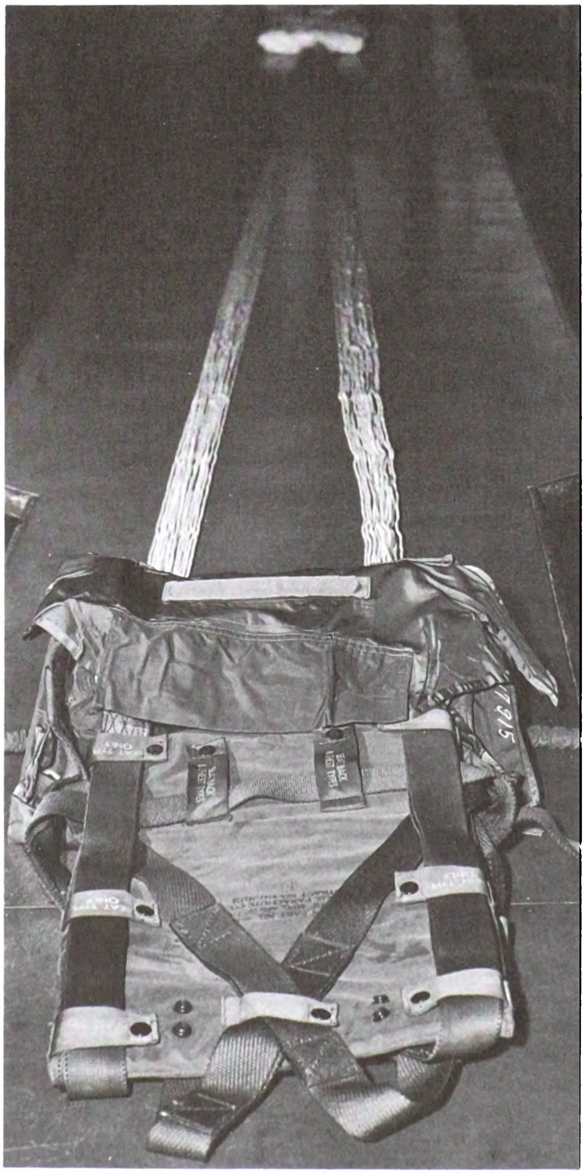


Figure 3-2.—Parachute layout for inspection.

checked for every possible damage which might endanger the life of a prospective user.

Check the peak for attachment of the vent collar and test the vent ring for strength and elasticity by stretching to its fullest extent.

Suspension Lines

Examine the connector link for cracks, rust, or corrosion. Check the continuity of the suspension lines and attachment at the links. Check zigzag stitching for defects both in the attachment at the links and at the skirt hem. Carefully examine each suspension line for fraying, projecting loops of thread, friction burns, and stains. This examination may be made by grasping one group of lines and placing them side by side in the hand. Slide the hand underneath the group and inspect about 2 feet, then turn the group over and check the reverse side. Continue this method of inspecting 2 feet at a time until the entire length of both groups have been carefully inspected.

If uneven lengths are found during the inspection of the suspension lines, the parachute must be sent to a major overhaul station for correction. Never attempt to shorten or lengthen a suspension line.

Parachute Container

Inspect the parachute container for rips, tears, stains, and proper attachment of flaps and hesitator loops. Watch for a bent or broken pack frame, and look at the pack stiffeners for evidence of chafing of the fabric enclosures and damage to the stiffeners.

Look closely at the attachment of the harness to the container. Be sure that all stitches are intact and made in accordance with latest directives. See that the end tabs are not damaged and are secured properly to the end flaps. The metal end tab must be positioned with the concave side toward the container when in position over the cone. If a cone is rough or badly damaged it must be replaced. Watch for damaged or unserviceable grommets and ripcord protector flap fasteners, and check pack opening bands for security of attachment of the eyes and general condition.

Harness

When checking the harness and lift web assemblies, examine the hardware for corrosion, rust, cracks, breaks, bends, or other damage and ease of operation. Check the webbing fo fraying, wear, abrasion, stains, defective stitching, and twists. Check the harness, insuring tha the webbing straps of the assembly follow th proper sequence.

Pilot Chute

Examine the pilot chute for stains, broken o loosened stitching in the seams, and holes o tears in the canopy. Check closely the coile spring for breaks, bends, and proper sprin tension. Check the connector cord for length o cord and loops and for damage and security o the bowline knots.

Ripcord and Ripcord Housing

The ripcord housing should be checked fo security of the end ferrules to the coil housing for breaks, crushing, or other deformation o the housing. Check the proper location an security of attachment.

The ripcord is checked for proper lengt bent, broken, or rough locking pins, the swage joints for attachment, and the cable for fraye strands and rust or corrosion.

Seat Cushions and Back Pads

Look closely at the cushions and back pad for overall condition. See that all keepers ar secure and that all snaps are in good workin order and fastened properly. A defective o missing snap fastener should be repaired o replaced, and damage to the cover or weakene stitchings should be repaired.

Tensile Strengths

Tensile strength is the greatest stress tha a material or substance can withstand longitudinally without rupture. Tensile strength fo textile fabrics is expressed in pounds per squar inch (of cross section) required to rupture th material. The breaking strength of webbings an tapes are given in pounds and vary with width thickness, weave, and the material used i construction.

When a new lot of material is received by parachute manufacturer, he is required to tes it not only for tensile strength but also for othe qualities such as porosity and tear resistance This is necessary in order to make parachutes

ich will meet all the rigid specifications of
acceptance test.

It is not feasible to maintain the equipment
essary for proper testing of all textile prod-
s found in each parachute loft; therefore, if
re is a reasonable doubt as to the adequate
ength of a piece of material or webbing, it
ould be sent to the nearest overhaul station
testing.

ocedure for Checking Stains

When a discoloration appears on the para-
ute pack or canopy it should be identified and
medied as soon as possible. The identification
these discolorations or stains may be accom-
ished by several methods, the best of which is
identify by sight the more common stains.

ACID.—Acid stains appear as a grey putty-
lored stain or a powdery ash, depending upon
strength of the acid solution which made the
ain. These stained areas must be neutralized
once and may be repaired only by cutting out
damaged spot and patching in accordance
th latest patching instructions. If acid is sus-
cted but not visible, test by touching litmus
per moistened with distilled water to the
spected area.

NOTE: Use caution when moistening the sus-
cted area to prevent the moisture from coming
contact with an object or substance which
ight contaminate the solution.

If the litmus paper turns red, acid is present
d the chute should be isolated from other parachutes until the extent of damage is determined and corrected.

SALT WATER.—Salt water stains are generally characterized by the appearance of a white crystalline substance on the surface of the material with a slight discoloration in the area. These stains should be removed by washing in clean fresh water as soon as possible after detection. The water may be warm, but not hot.

OIL STAINS.—Oil and grease stains have a greenish color and produce an oily or greasy feeling when touched or rubbed between the fingers. These stains may best be removed by application of isopropyl alcohol or other approved cleaning solvent.

Canopies badly stained by any of these or other injurious substances should be returned to a major repair station for repair or disposition after all possible steps have been taken to neutralize the damage.

MAINTENANCE AND DISPOSITION OF REPAIRS

Table 3-1 is offered as a guide to aid in the disposition of repairs. This list shows which defects constitute a major repair and which are classed as minor repair. Major repairs must be carried out by a major overhaul station equipped to do this work, while minor repairs may be made by any qualified Parachute Rigger.

Table 3-1.—Disposition of repairs.

Pilot Chute and Main Canopy

Inspect for	Disposition
curity of pilot chute to main canopy.	Minor repair; retie or replace webbing.
nt or broken spring.	Minor repair; straighten or replace pilot chute.
ose swaged fittings.	Minor repair; replace pilot chute.
odifications in accordance with technical publications.	Generally involves a minor repair, but occasionally involves a major repair.
amaged suspension lines.	Major repair; replacement of line or group of lines.

Table 3-1.—Disposition of repairs—Continued.

Pilot Chute and Main Canopy—Continued

Inspect for	Disposition
Suspension lines secured out of rotation on the removable links.	Minor repair; slip lines off removable link and replace in proper sequence.
Stains.	Minor or major repair, depending on the origin and size of area or areas. For minor repair, test for a caustic substance in the affected area and in adjoining areas. After a negative test, wash and dry, then retest. Advanced small caustic stained areas may be cut out, treated as a tear and patched. Areas indicating a caustic element but not suffering any apparent damage may be neutralized, washed, and dried. Retest. A ‘‘canopy change’’ is classifed as a minor repair so long as no sewing is involved in the operation. Large or numerous small caustic stained areas require a major repair classification.
Tears in the cloth.	Minor repair with limitations. Tears 8 inches or under not crossing radial seams, diagonal seams, skirt, or vent hems. Only two single or one double patch per section, and when it becomes necessary to exceed this, the repair is classified as major. Major repair. Tears or holes greater than 8 inches. Any size tear across seams or the vent and skirt hems.
Security of tackings. (Pilot chute vane type.)	Minor repair; retack.
Loose or severed stitching.	Minor repair; brush loose stitching back into cloth. Short lengths of damaged stitching may be resewed.
Damaged vent ring.	Minor repair; replace.

Harness and Pack

Inspect for	Disposition
Security of lift webs to links.	Major repair; if lift web attachment sewing is involved. Minor repair; tighten removable connector link screws to hand tightness.

Table 3-1.—Disposition of repairs—Continued.

Harness and Pack—Continued

Inspect for	Disposition
maged webbing: badly chafed, separated, or cut.	Minor repair; harness replacement involving no sewing; salvage hardware.
difications in accordance with technical publications.	Generally involves a minor repair, but occasionally involves a major repair.
urity of all harness tackings; ripcord housing, grip pocket, lift webs to pack, pararaft kit container, seat cushion and back pads, etc.	Minor repair, retack where necessary.
ose or severed harness stitching.	Major repair; if more than several stitches, replace harness. (Replacing harness is a minor repair when lift web sewing is not involved.)
ined and dirty harness.	Minor repair; test for caustics; if present, remove harness, neutralize, wash, dry and retest. If any doubt of the tensile strength exists, return harness to major repair station for test.
proper location and operation of hardware. Permanent twists in chest and back straps.	Major repair; return harness to major repair station for overhaul.
urity of pack to harness.	Minor repair; machine sew keepers, retack. All pack changes are classified as a minor repair.
maged ripcord, housing, grip pocket, back pads and seat cushions.	Minor repair. Replace and salvage damaged parts.

SPECTION REPORT

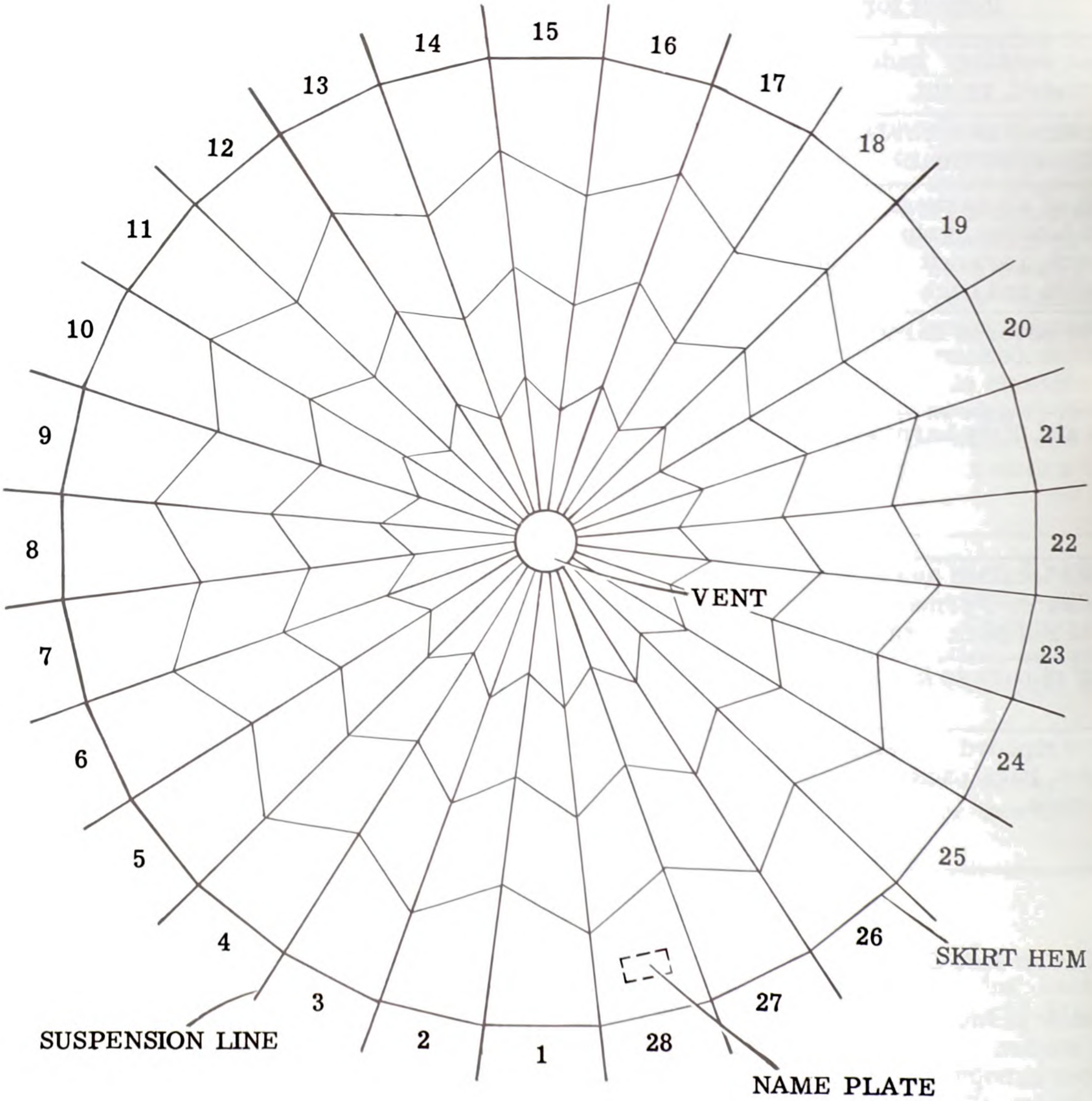
When a parachute is forwarded to a major pair station for examination or repair, the mpleted canopy chart (fig. 3-3), an inspection port form (fig. 3-4), and the Parachute story Card, NavWeps 2771 (fig. 3-5), must company the parachute in its shipment. This ormation is necessary to enable the overhaul tion to complete the repairs in the shortest ssible time and expedite the return of the rachute to service by permitting immediate ention to those parachutes most readily pairable.

The parachute inspection form shown in fig- e 3-4 may be prepared locally for use of the rachute loft. Use this form whenever repairs are to be made. DO NOT MAKE ANY MARKS ON THE CANOPY.

TRANSFER

As a Parachute Rigger you will not ordinarily be concerned with transfer of parachutes. This is a function of the supply officer. If it becomes necessary to transfer a parachute either with an aircraft to an overhaul station, or for any other reason, the parachute must be turned into the supply officer for the transfer.

NOTE: Parachutes and actuators which have been reclaimed following emergency bailout or ejection should be removed from service and turned in to the nearest supply activity on an exchange basis in accordance with BuWeps Inst. 13480.2.



SERIAL NO. 69299 DATE 12-25-63
TYPE NC3-R INSPECTOR M. Lovin
REMARKS unidentified stain gore 28-a

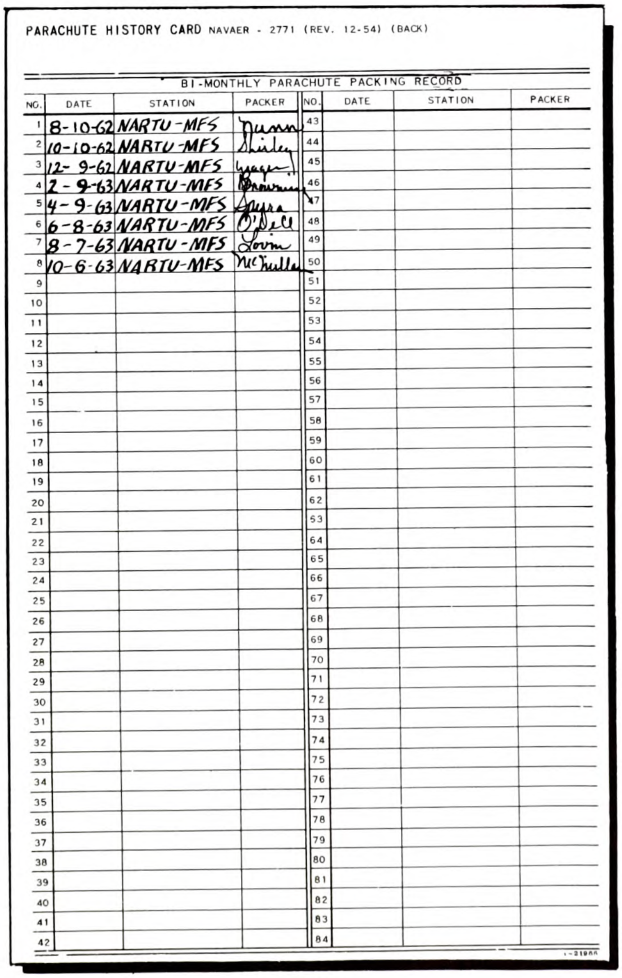
Figure 3-3.—Canopy chart.

INSPECTION REPORT Date 5-21-63

Parachute No. NC-3R 69299 Inspector Strange

PART	O.K.	REATTACH	REPAIR	REPLACE	REMARKS	CHANGES (Authorized by)
HARNESS:						
Hand Grip Pocket				✓		
Ripcord Housing		✓				
Releasing Device	✓					
Webbing and Attachment	✓					
Metal Fittings	✓					
Back Cushion	✓					complied with ACSEB 32-61
Modifications	✓					
PACK:						
Cushion				✓		
Hesitator Loops	✓					
Flaps and Tabs	✓					
Stiffeners	✓					
Pockets	✓					
Grommets	✓					
Cones	✓					
Hooks and Eyes	✓					
Elastics		✓				
Frame	✓					
Modifications	✓					
SUSPENSION LINES:						
Zigzag Stitching	✓					
Suspension Lines	✓					
Links to Skirt	✓					
CANOPY:						
Fabric	✓					
Skirt	✓					
Radial Seams	✓					
Zigzag Stitching	✓					
Diagonal Seams	✓					
Vent Collar	✓					
Vent Ring	✓					
PILOT CHUTE:						
Pilot Chute Connector Cord				✓		
Fabric	✓					
Rib Pockets	✓					
Wire Frame	✓					
Suspension Lines	✓					

Figure 3-4.—Inspection report form.



PARACHUTE HISTORY CARD NAVAER - 2771 (REV. 12-54) (BACK)

BI-MONTHLY PARACHUTE PACKING RECORD

NO.	DATE	STATION	PACKER	NO.	DATE	STATION	PACKER
1	8-10-62	NARTU-MFS	Dunn	43			
2	10-10-62	NARTU-MFS	Shirley	44			
3	12-9-62	NARTU-MFS	Yeager	45			
4	2-9-63	NARTU-MFS	Browning	46			
5	4-9-63	NARTU-MFS	Spyra	47			
6	6-8-63	NARTU-MFS	O'Dell	48			
7	8-7-63	NARTU-MFS	Lovin	49			
8	10-6-63	NARTU-MFS	McMullan	50			
9				51			
10				52			
11				53			
12				54			
13				55			
14				56			
15				57			
16				58			
17				59			
18				60			
19				61			
20				62			
21				63			
22				64			
23				65			
24				66			
25				67			
26				68			
27				69			
28				70			
29				71			
30				72			
31				73			
32				74			
33				75			
34				76			
35				77			
36				78			
37				79			
38				80			
39				81			
40				82			
41				83			
42				84			

Figure 3-5.—Parachute History Card, NavWeps 2771.

SURVEY

To survey is to examine, inspect, or consider carefully. Therefore, survey boards are composed of an officer (or officers) appointed by the commanding officer to examine, inspect, or consider carefully the facts surrounding an accountable item which, for reasons of loss, damage, deterioration, or normal wear, must be expended from the records.

There are two types of surveys—formal and informal. The choice of survey to be used is designated by the bureau or office concerned with the item to be surveyed, or by the commanding officer. The formal survey is made by a commissioned officer appointed by the commanding officer, or by a survey board appointed by the commanding officer and consisting of three officers, one of whom must be a commissioned officer.

The custodian of an item to be surveyed prepares a written statement of the circumstances as known or suspected; then the division officer originates a rough Survey/Request, Report, and Expenditure Form (SandA 154) through normal channels. This request provides a record showing the cause, conditions, and responsibility for the survey, and recommendations for disposition and authority to expend the item or materials from the records.

In the case of a parachute which has reached its final striking date (7 years from date of manufacture), it is turned in to the supply officer for forwarding to the nearest major overhaul station for disposition.

PUBLICATIONS

Aeronautical publications are issued by authority of the Chief of the Bureau of Naval Weapons. These publications are the sources of information for guiding naval personnel in the operation, inspection, and maintenance of all aircraft and related equipment within the Naval Establishment. By proper use of these publications, all survival equipment can be properly inspected and maintained. Also, by properly utilizing certain of these publications, a good survival training program may be inaugurated and kept up to date.

Aeronautical publications are grouped into two major classes or groups—those issued in the form of MANUALS and those issued in the form of LETTER material.

When a new aircraft, engine, accessory, or (in the case of survival equipment) a new item of equipment is accepted by the Navy, manuals necessary to insure its proper operation and maintenance are prepared and issued to all activities using the equipment. For example, NavWeps 13-10-501 was issued to cover the operation and maintenance of the Full Pressure Suit (Mk 4). Supplemental information and other directive type publications that must be issued from time to time are issued in the form of letter material. These include such publications as Instructions, Notices, Bulletins, and Changes.

INDEXES

The three indexes which will be most helpful to the Parachute Rigger in locating information re the Navy Stock List of Forms and Publica- ons (NavSandA 2002, Parts C and D), the Con- olidated Publications Index (Admin. Office Inst. 215.4A), and the Naval Aviation Biophysics and urvival Equipment Publications Index (Aviation afety Center publication).

avy Stock List of Forms and Publications

All aeronautical publications, both letter and anual type, are assigned a title and code num- er and listed in the Navy Stock List of Forms nd Publications, NavSandA 2002 (formerly Nav- eps 00-500 Numerical Sequence List, Part 1). avSandA 2002, Parts C and D, are the basic ssues of the index and contain a numerical list- g of all aeronautic publications by code num- er, title, security classification, and date of atest issue. In the front of Part C of this index s a table of contents and complete instructions or using the index. For best results when using is or any index, read the instructions given for s use.

onsolidated Subject Index (AO Inst. 5215.4A)

Another important index which is available s the Consolidated Subject Index. This index lists ll publications available on practically any given ubject. As an example under "Footwear," in- tructions are listed from BuWeps, BuShips, uSandA, and BuDocks.

Naval Aviation Biophysics and Survival Equipment Publications Index

Another index to aid the PR in keeping up to date with current instructions is the Naval Aviation Biophysics and Survival Equipment Index, prepared and kept up to date by the Naval Aviation Safety Center. This index lists only those publications which are of interest to pilots and Parachute Riggers. Included among these are ACSEB's, Aircrew Systems Bulletins, Support Equipment Bulletins, Airframes Bulletins, and other miscellaneous publications.

Miscellaneous Publications

Other publications of importance to PR's, but not of the manual or letter type, are allowance lists. These consist of listings of the equipment and material necessary to place and maintain various activities in a material readiness condition.

Allowance lists are identified by sections and certain of these, such as sections A, H, and G are issued as individual publications. The list which will be of the most interest to PR's is the section H allowance list. This list includes the safety and survival equipment allowances for outfitting and maintaining an activity.

CHAPTER 4

PARACHUTE PACKING AND RIGGING

Packing is more than a matter of inserting a canopy into its pack. It is a combination of rigging, inspecting, and packing. However, most of the inspection phases of the operation can be carried out independently. Thus, inspection was treated separately in the previous chapter. The perfect working of the parachute depends on the methods used in the rigging and packing processes. Packing is essentially the same for all parachutes, although the external rigging differs considerably. If a thorough and reliable packing procedure is understood, the Parachute Rigger should be able to apply that knowledge to any type of parachute.

The beginner may take as long as 45 minutes to pack a parachute. A large part of that time will be spent on the stowage of suspension lines. After a few weeks practice, this time will shorten to an average of 20 minutes or less until peak performance is reached. Due to the uniform system taught to Navy Parachute Riggers, any two men can soon work in harmony and form a good packing team. It should be kept in mind that speed is secondary to accuracy. A good Parachute Rigger will recognize his best packing speed and settle down to a good reliable pace that guarantees perfection.

RIGGING TOOLS

As a general rule, rigging a parachute in preparation for packing involves tacking various appendages and assemblies to the parachute. Making these tackings necessitates the use of several special type handtools common only to hand sewing.

The most useful of these—the sail needle—is used in passing the thread or cord through the materials being tacked. The difficulty encountered in passing the needle through the various weights and thicknesses of webbing, fabric, and/or canvas makes the use of other tools such as the awl, the sewing palm, and smooth-jawed pliers necessary in rigging a parachute for packing.

SAIL NEEDLES

The most distinctive feature of the sail needle is its broad, three-edged shape in relation to its size. Although the shape of the sail needle sometimes prevents its use in hard, closely woven fabrics, it is still the most useful hand sewing needle for parachute maintenance. It is the toughest needle available and will take a lot o rough use without breaking at the eye, as d many of the round needles.

Sail needles are issued in various numbere sizes. The larger the number, the finer th needle. The most popular sizes are the 14 an 16, shown in figure 4-1 along with the No. 10 size.

When selecting a needle for use, remembe that the eye is intended to offer just enough resistance to the thread or cord to keep the needl in place and prevent it from sliding out of position. The cord or thread should pass freel through the eye of the needle. Difficulty is encountered in passing a needle through a piece o cloth when the needle is threaded with a cord to heavy for the eye. The choice of size therefor depends on the size of thread or cord to be use in sewing. An improper selection will interfer with speed and efficiency and increase the possibility of damaging the material.

SEWING PALM

The sewing palm is a small metal disc (usually lead) inserted in a leather glove type devic

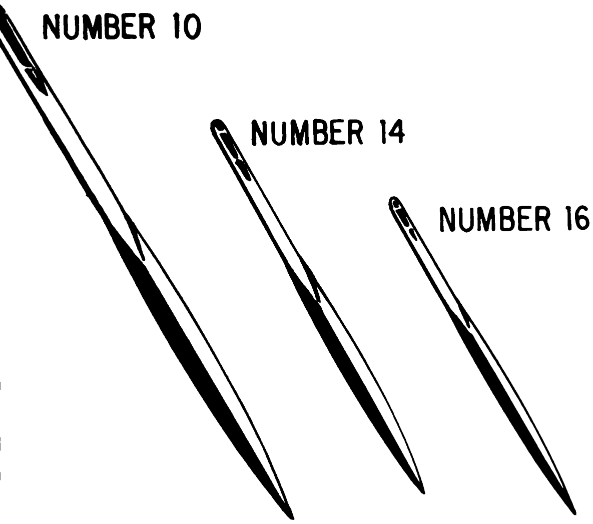


Figure 4-1.—Sail needles.

is designed to be worn in the palm of the hand d is used to aid in pushing a sail needle through e material being sewn or tacked. (See fig. 4-2.)

WL

The awl is another instrument used as an aid sewing heavy material where pushing the sail hand sewing needle becomes difficult. It is a arp pointed instrument, with a handle attached, sed for punching holes in a fabric or material ior to inserting the needle.

LIERS

Other tools which aid in hand sewing are iers, either the needle-nosed or the combina- on slip-joint type. In either case they must be nooth jawed to prevent damage to the needle.

Among miscellaneous rigging tools needed in e parachute loft are a sharpening stone, for eping needles, awls, and knives in tip-top con- tion; a knife for miscellaneous cutting jobs; and soldering iron or other suitable instrument for aring nylon.

PACKING TOOLS

The Parachute Rigger's complete packing ol kit (fig. 4-2) reveals a simple array of tools. The individual tools, while unimpressive in appearance, are quite specialized in application. These tools cannot be drawn from stock individually, but may be drawn through supply as a complete kit. Some of these tools may be made locally.

The long bar (E) is a bar of aluminum approximately 1 3/4 inches wide, 18 inches long, and one-fourth inch thick. The edges must be rounded and the entire surface smoothed and polished to prevent damage to the fabric of the canopy. It is used to make the folds in the canopy and to aid in smoothing out the pack.

The fid (F) can be made of aluminum or of wood. It is about 8 inches long and the same approximate width and thickness as the long bar. It is used in smoothing out the pack and tucking in the flaps.

The suspension line hook (L) is made of a suitable metal to give it the strength and durability needed to pull the suspension lines through the hesitator loops when stowing the lines in the pack. It must be free from all burrs and rough edges.

Temporary locking pins (B) are made of 0.080 stainless steel wire in the general configuration shown in figure 4-2. They are used to secure the pack in the temporarily closed position after it has been placed in the container and before the ripcord has been inserted in the locking cones.

The suspension line holder (K) is made of aluminum and is designed in the general shape of three fingers. This design affords two slots between the "fingers" into which the suspension lines can be temporarily placed after the continuity has been checked. When placed in these slots and held in place by shot bags, they will remain straight until ready to be stowed in the hesitator loops.

Shot bags (G) are convas bags approximately 1 inch in diameter and 16 to 18 inches long. They are filled with lead shot and provide weight to hold the canopy and suspension lines in position during the packing process.

Parachutes are lifesaving devices made of nylon. Due to the light weight of nylon (1.1 ounces per square yard) and its susceptibility to damage, special treatment must be given to preclude any action which might be injurious to the material of the parachute assembly. Particular attention should be given to any tool which might come in contact with the canopy or suspension lines. Burrs and rough areas on any of the metal

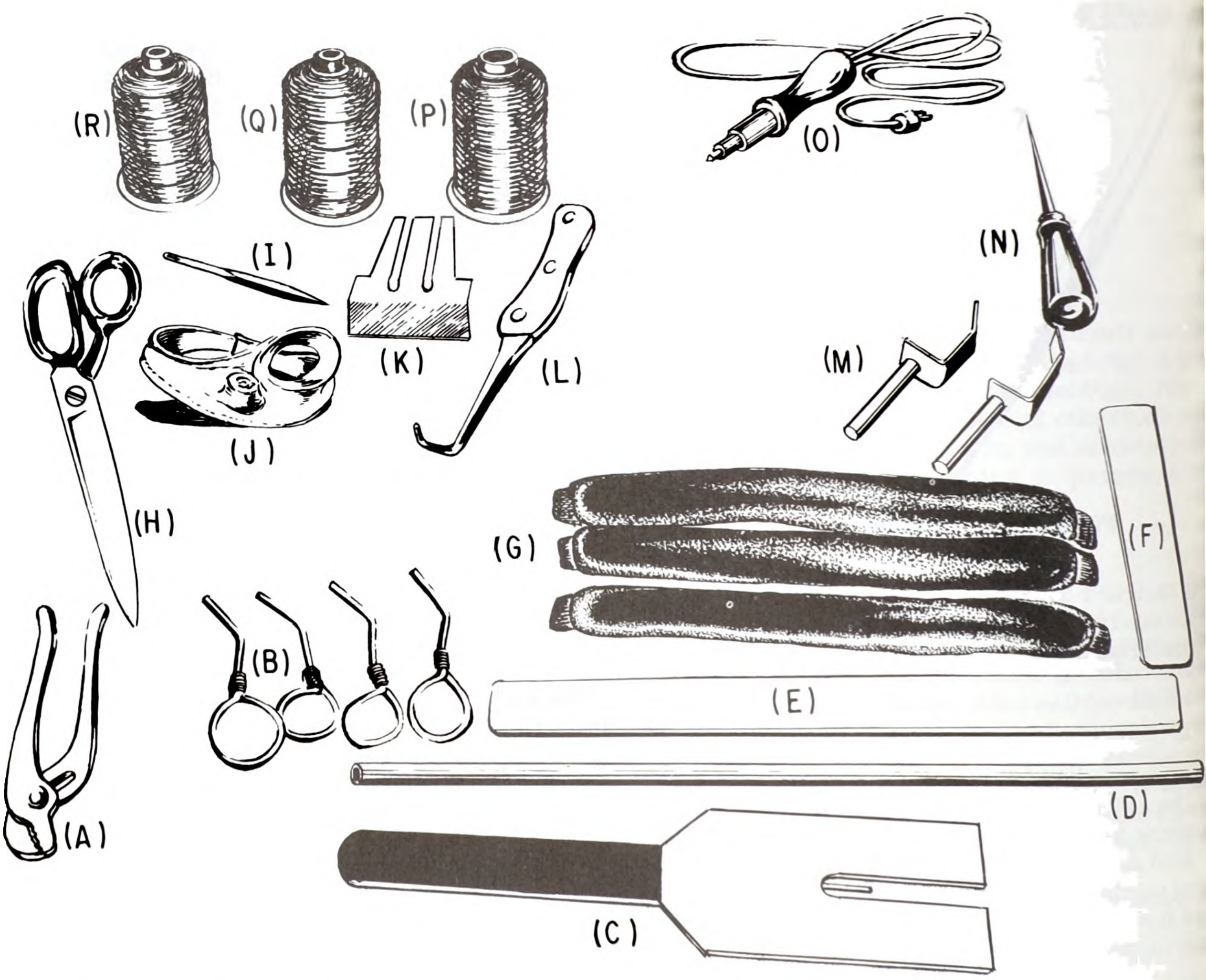


Figure 4-2.—The Parachute Rigger's packing and servicing tools. (A) Pliers, (B) temporary locking pins, (C) pilot chute locking tool, (D) pilot chute tube, (E) long bar, (F) fid, (G) shot bags, (H) shears, (I) sail needle, (J) sewing palm, (K) suspension line holder, (L) packing hook, (M) tension hooks, (N) awl, (O) nylon searing tool, (P) nylon 6-cord, (Q) size E nylon thread, (R) size A nylon thread.

parts must be polished down, using 0 grit emery cloth.

REMOVING SUSPENSION LINE ENTANGLEMENTS

Suspension line entanglements (dips and twists) are caused by the canopy or harness passing in between the suspension lines. In chapter 2 we studied the method of attaching the suspension lines to the links and in tur how the links are attached to the lift webs (the harness.

In separating the lines to check for dip and twists, first find the gore bearing th nameplate and place it uppermost in the cente of the table. Separate the suspension lines int two equal groups, left and right, by counting 1 lines on each side of the nameplate gore. If an lines are tangled, the lines will not run clea from connector link to canopy skirt, and th dip or twist must be removed.

A DIP is a line or group of lines passing IROUGH another group of lines. A TWIST a line or group of lines passing AROUND other group of lines. Do not pack a parachute th a dip or twist in the suspension lines. is would prevent proper opening of the para- ute and might very well result in the death a pilot or crewman.

Most twists may be removed by simply winding the lines in the opposite direction of e twist, but dips present a much more dif- ult problem. There are two commonly used ethods by which dips may be removed—the o-group method and one-line method.

The two-group method is satisfactory when ere are but few dips in the suspension lines. ith the parachute hooked up loosely, separate e suspension lines at the skirt into two groups. old one group in each hand and work toward e harness, separating the two groups as you go. is forces the dips down to the link end of the spension lines and makes it possible to see em clearly. Still holding the suspension lines, ve the helper take the suspension line con- ctor links off of the spreader bar and pass e harness and container through the suspen- on lines wherever one line passes through the st. Care must be used not to tangle the rness while passing it through the lines. ips can be put back into the lines as fast as ey are removed.

The one-line method of removing dips is so a good one. It is usually used if there are large number of dips and twists in the lines. owever, either method may be used according your own personal preference.

Lay out the parachute as for the two- oup method. Pick up either line No. 1 or ne No. 28 and, while holding it loosely in e hand, walk toward the harness. With the her hand, form a loop of all the lines around e hand. Hold the single line and place all e lines that go over this line over the arm d those that pass under the line, under the m. Pass the container and harness through e loop thus formed.

The last step in removing dips and twists om the suspension lines by either method to check the lines for continuity. This is only positive method of determining if job has been properly done. To check the es for continuity have the helper stand at skirt hem and, starting with suspension e No. 1, lift the lines away from the group e at a time while checking the same line at the connector link to make sure that each line is in sequence.

DRYING PARACHUTES

In accordance with current directives, parachutes must be aired and dried prior to each repacking, and when in service use, at least every 60 days. After the parachute has been completely inspected, all repairs and adjustments made, and all tangles removed from all parts of the parachute assembly, it is time for airing and drying the canopy.

Parachutes should be suspended by their peaks for airing without any part of the canopy or lines touching the deck, bulkhead, or any projection which might damage the fabric. The drying tower (dry locker) should be of sufficient height (40 feet) to accommodate hanging of a fully suspended parachute, including the suspension lines. However, if a room of this height is not available, the canopies should be hung as high as possible, with the suspension lines chained and placed on a smooth-top table along with the harness and container directly under the canopy.

Parachutes should be hung by the peak to a halyard snap which has been attached to a hoisting line. The hoisting lines are suspended from a pulley arrangement secured to a strong member of the overhead. These pulleys should be placed at intervals far enough apart (24 inches) to prevent the canopy of one parachute from touching that of another.

CHAINING SUSPENSION LINES

Suspension lines are chained by tying a series of hitches to form a chain. Grasp the lines at a point near the skirt hem and make an overhand knot. Reach through the loop of this knot and grasp the lines again and pull them through the loop. This makes the first hitch. Tighten the loop of the first hitch and repeat the process of reaching through the loop of each successive hitch and pulling through another loop until the entire length of the suspension lines is chained. Pull all of the chained lines through the loop of the last hitch to complete the chain. (See fig. 4-3.)

KNOTS USED IN PARACHUTE MAINTENANCE

In addition to the overhand knot used in chaining the suspension lines, Parachute Riggers should learn to tie the half-hitch (a variation of the overhand knot). The half-hitch is used to make the ripcord safety tie and also used with the clovehitch in securing the suspension lines to the connector links. Other knots which Parachute Riggers need to know are the square knot, bowline knot, fisherman's knot, and surgeon's knot.

The square knot may be used in most cases in which a knot is required and a particular knot is not specified. The bowline knot is used to secure the pilot chute connector cord to the apex of the parachute. The fisherman's knot and the surgeon's knot are used in tying off various tackings on parachute harness and containers where a knot that will not slip is needed. (See fig. 4-4.)

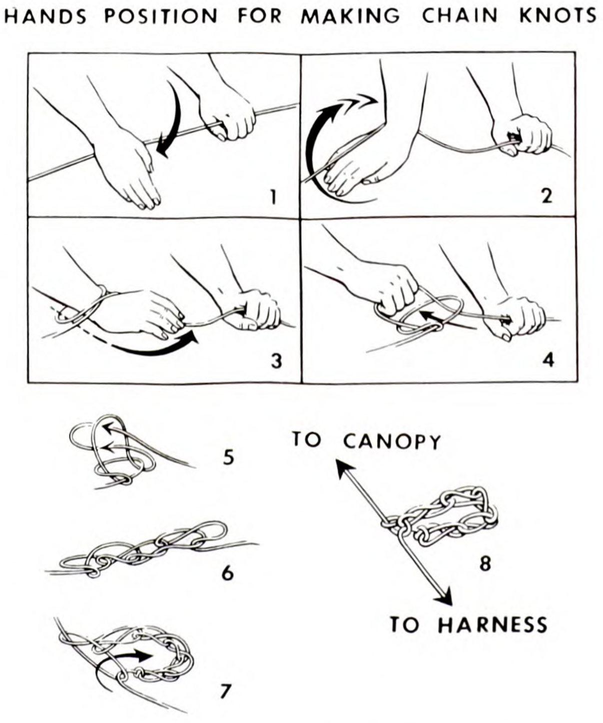

HANDS POSITION FOR MAKING CHAIN KNOTS
1
2
3
4
5
TO CANOPY
6
8
TO HARNESS
7

Figure 4-3.—Steps in chaining suspension lines.

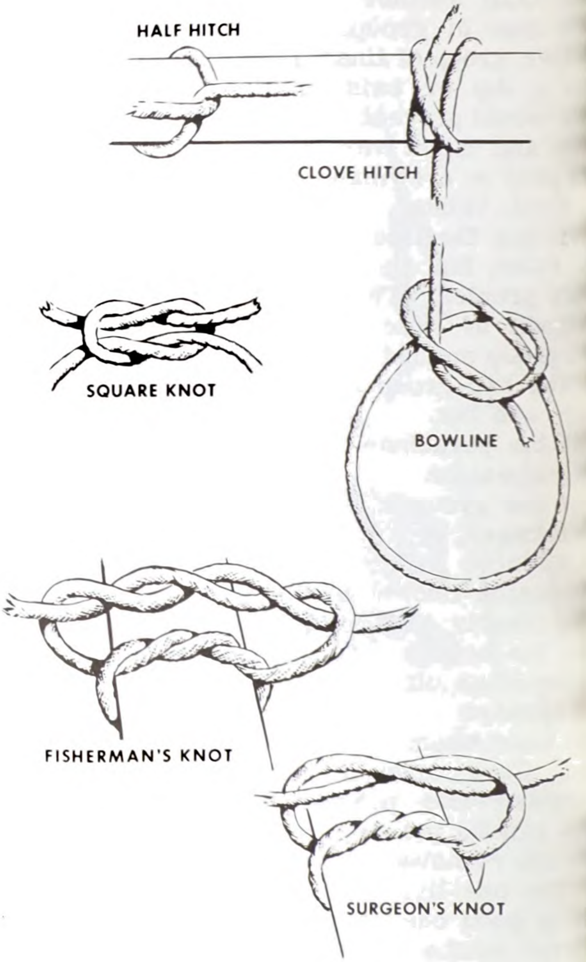


Figure 4-4.—Knots and hitches used in parachute maintenance.

HANDLING PACKED PARACHUTES

The most effective way to explain the sub ject of handling packed parachutes is to list series of general rules in the form of DO's ar DON'Ts.

1. Do not pick up a parachute by its li webs or ripcord handgrip. Lift web tacking break relatively easy and when they do, th suspension lines are almost certain to becom disarranged. Carrying or attempting to carr a parachute by its ripcord grip will alway result in a premature opening.

2. Do not place a parachute near any sourc of heat. Heat will cause brittleness in nylo fabric.

3. Do not place a parachute in or near any rce of dirt, grease, or oil. Stains can be remely harmful to fabrics when they contain ong acids or alkalies.

4. Do not drop a parachute. Dropping a rachute can bend or break the metal comnents and perhaps cause failure of the entire sembly.

5. Do not leave a parachute where it is ely to get wet.

6. Do not leave a parachute where heavy jects can be dropped or placed on it. Pertting a parachute to be carried in a cargo t along with squadron cruise boxes or similar ar displays poor handling techniques.

7. Use the chafing bag to cover the paraute when it is expected to be kept out of rvice for a considerable amount of time.

8. Be prepared to give brief lectures inructing personnel on how to handle parachutes.

Figures 4-5 through 4-8 illustrate the best thods of carrying packed parachutes when ged with and without the pararaft kit.

AFING BAGS

The parachute chafing bag, closed with two g slide fasteners, provides ample stowage otection for the parachute in a packed or packed condition. The slide fasteners, when ened, offer a large cavity capable of receiving standard size parachute. The basic rules stowing a parachute in the chafing bag e:

1. Chain the suspension lines.
2. Place the harness in the bag first.
3. Let the pack act as the separator between canopy and hardware.
4. Accordion pleat the canopy into the bag.
5. When appropriate, and for very short riods in transit, compress the pilot chute into bag, using the side as a backstop for the of the pilot chute. Otherwise, disengage pilot chute and stow separately.
6. Be careful when closing the bag and do not tch the canopy fabric in the slide fasteners.
7. Do not stow the bag directly on the floor.
8. Make certain that the bag is properly nciled or tagged for identification purposes.

IPPING CANS

Parachutes are shipped from the manuturer in sealed cans and may remain in the shipping can as long as they are not bent, crushed, or ruptured. Once the can is opened, the parachute should be placed in service, or placed in a chafing bag for stowage.

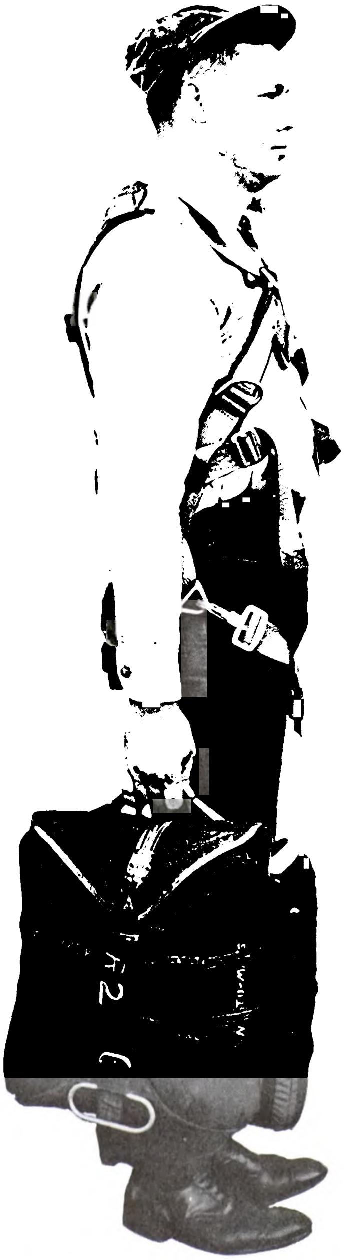


Figure 4-5.—Method of carrying the chest type parachute with and without the pararaft kit.

SAFETY PRECAUTIONS

Extra care must be given to the handling of packed parachutes, especially on the flight line. Instruction of squadron personnel in proper handling techniques is the responsiblity of the Parachute Rigger.

Extra instruction should be directed to plane captains since they are required to handle parachutes frequently. The following are some of the precautions which should be observed by al personnel handling parachutes:

Parachutes should not be hauled around o dirty bomb trucks, trailers, and the like.

Parachutes should not be placed on the win or tail surfaces of aircraft. They should b placed immediately in the seat or other storag space in the aircraft. Parachutes must neve be placed in a wet seat.

Seat type parachutes should be carried ove the shoulder, with the hand through the gri locking it in its pocket as shown in figure 4-

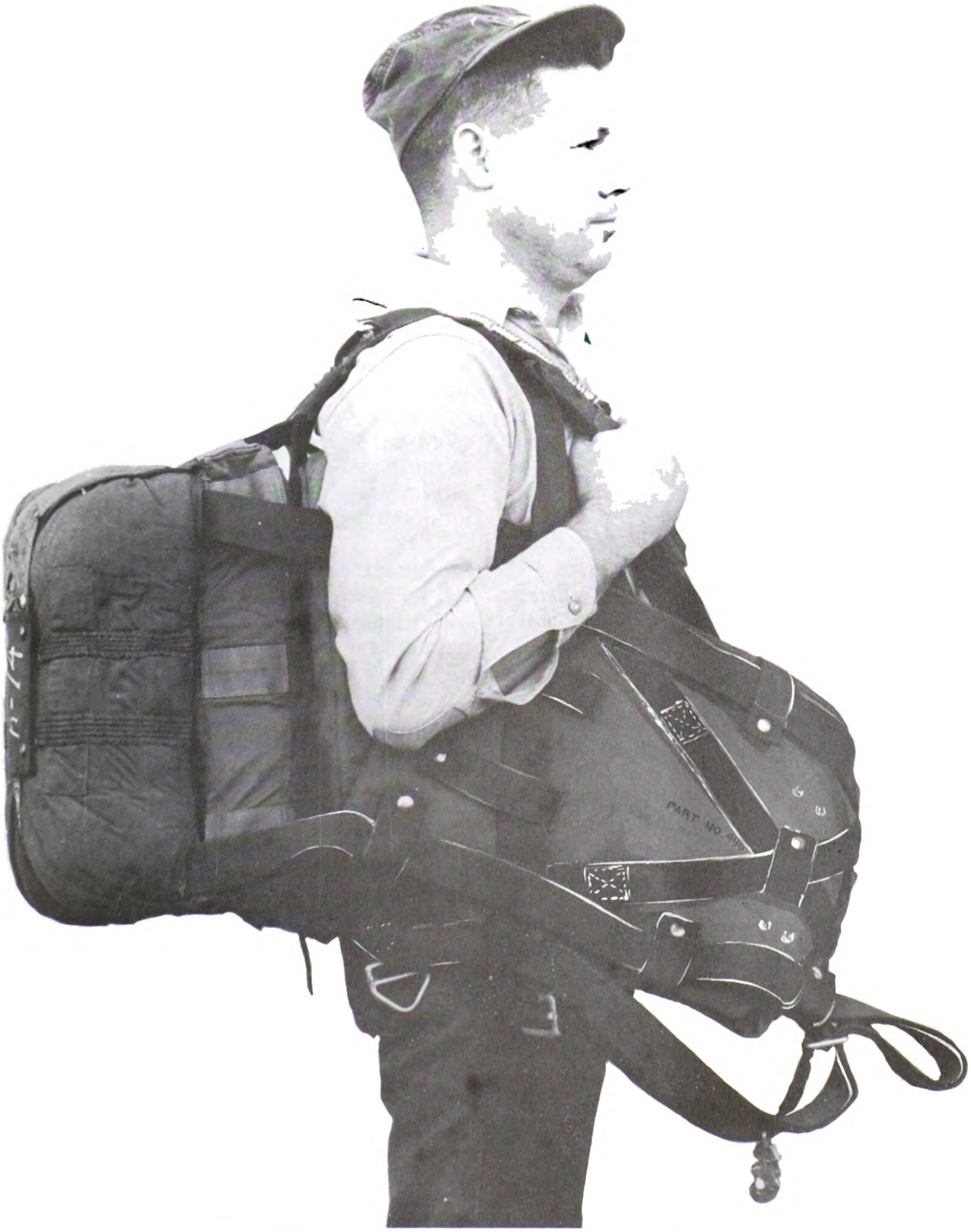


Figure 4-6.—Method of carrying the seat type parachute when rigged with or without the pararaft kit.

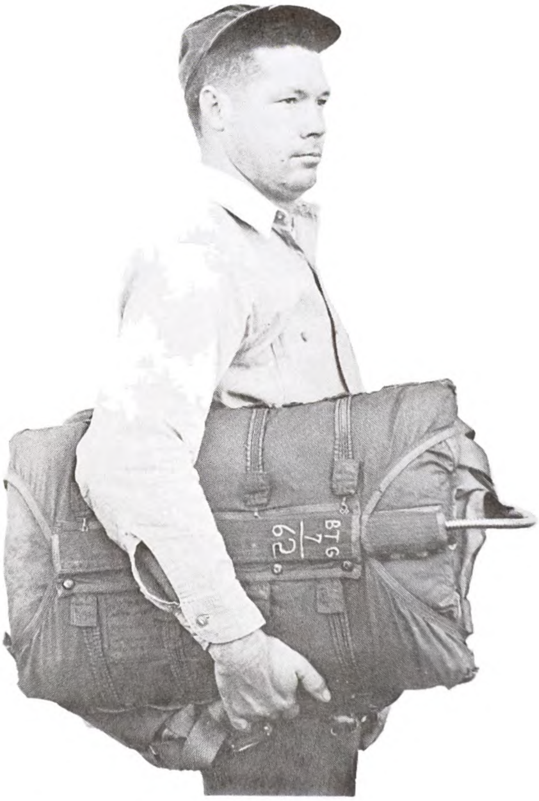


Figure 4-7.—Method of carrying the back type parachute without the pararaft kit.

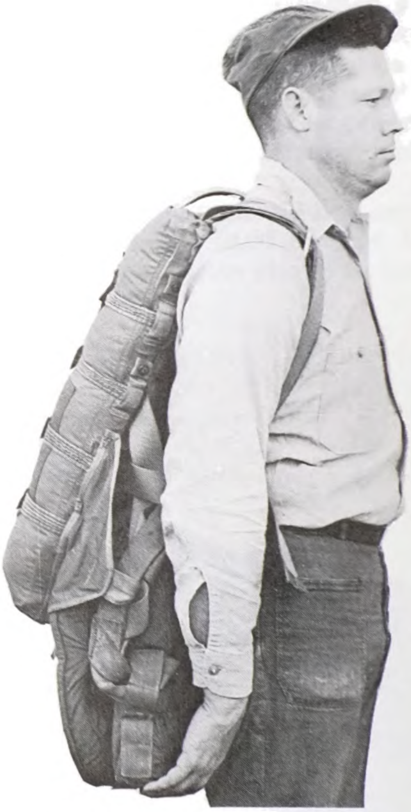


Figure 4-8.—Method of carrying the back type parachute when rigged with the pararaft kit.

CHAPTER 5

PACKING AND RIGGING THE CHEST TYPE PARACHUTE

The Navy standard chest type parachute is esignated NC-3 (Navy chest, third modification) d is referred to as such throughout this apter. It has a 28-foot canopy, constructed of pstop nylon cloth. A quick-fit harness (de-ribed in ch. 2) is used in conjunction with the C-3 parachute.

The NC-3 is rigged and packed by the Navy pproved two-man method. The average time of gging and packing will vary, depending on the perience, ability, and skill of the team in orking together.

The NC-3 is used primarily in transport d patrol type aircraft. The advantage of the C-3 in these types of aircraft is movability, as rewmen ordinarily wear only the harness during ight. With the quick-fit harness, crewmen can e ready for bailout in a matter of seconds.

RIGGING THE CHEST TYPE PARACHUTE

The following steps are recommended ethods of rigging the chest type parachute:

1. Clean the table so that the parachute will ot touch any damaging foreign matter.
2. Lay out packing and rigging tools and sition the tensioning devices.
3. Lay out the parachute. The lift web sembly, in this case, is not tacked to the ck. It is not always necessary to break and make the tackings that go together in the gging of certain appendages. We start here om the completely unrigged condition so that l rigging problems can be adequately covered.

ROCEDURE FOR RIGGING

Packing and rigging of parachutes must go nd-in-hand, since some of the rigging prosses must be done after certain of the packing eps are taken. For instance, the lift web cking of the chest type—a rigging step—must done after the parachute is whipped and folded, which is a packing step. Whipping and folding of the canopy is explained later in this chapter.

If the suspension lines are chained, slip the securing hitch as the helper makes ready to pull the peak to the end of the table. As this is done, the suspension lines unchain, and by the time the peak of the canopy has reached the end of the table, the suspension lines will be completely free. Figure 5-1 illustrates the proper attitude of the lift web assembly before attaching it to the pack. The packer's station is on the left-hand side of the table, and the helper's station is on the right-hand side. (This is viewing the table from the packing end.)

Check the assembly for entanglements. Make sure that the canopy is turned right side out, that the lift web assembly is constructed properly and contains no twists, and that the suspension lines are free from dips and twists. A careful check of the continuity (described in ch. 4) will complete the check.

The tongues of the quick connector snaps of the lift web assembly should be up. (See fig. 5-1.) Note the stencil marking "TOP," with arrows on either side—this information is carried on cross connector straps to aid in connecting the parachute to the harness.

The chest pack lift web assembly tacking must be very strongly made to hold the pack securely while the parachute is being worn and at the crucial time of egress from the aircraft. This tacking must be drawn up tightly to prevent slippage during hookup to the harness.

To make the tacking, first position the lift webs on the table with the word TOP and the arrows up. NOTE: Make sure that the suspension lines are free from dips and twists. Raise the lift web assembly from the table and move the container toward the canopy. Position the container under the lift webs and place the connector snaps (opening out) ready for tacking. (See fig. 5-2.)

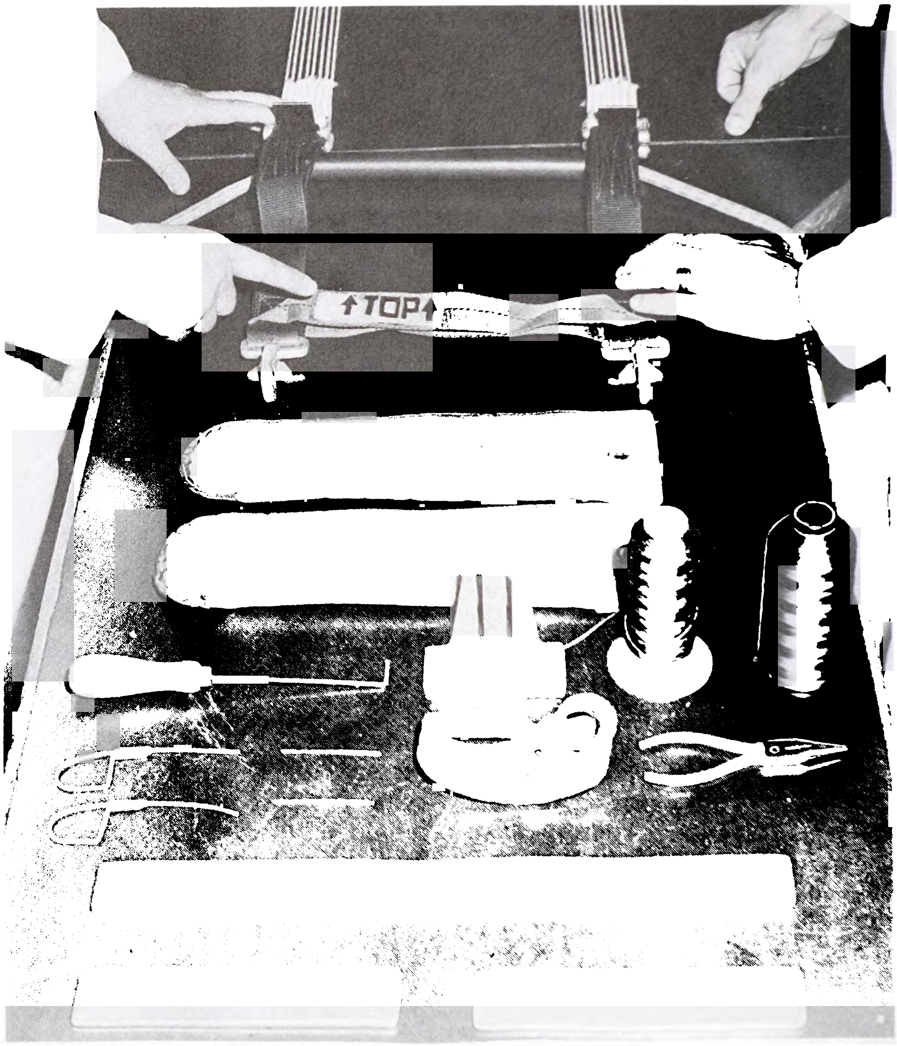


Figure 5-1.—Parachute, tools, and equipment laid out on the table.

The pack opening bands should be attached after completion of the lift web tacking. The hooks on one end of the pack opening bands are attached to the wire anchoring eyes on the pack and pinched closed with a pair of flat nosed pliers. This closing of the hooks prevents loss during the repacking process or at other times when the parachute is unpacked.

RIGGING WITH PARARAFT KIT

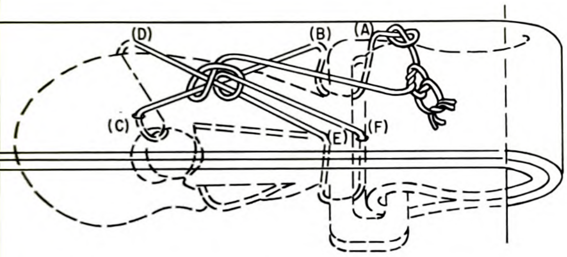
When rigging the NC-3 with the pararaft kit, sew 3 lengths of nylon tape on the pack and on the pararaft kit container, as shown in figure 5-3. Insert a 10-inch length of type III suspension line through the loops formed by this attachment.

''BOX X'' STITCH

The ''BOX X'' stitch is just what the nam implies. It is a series of stitches sewn in rectangular shape with an X or cross stitchin running diagonally from one corner of th rectangle to the other. The standard machin lockstitch is used in making this stitch with th usual 8 to 12 stitches per inch. This stitchin is necessary when sewing tape or webbin appendages on the parachute or to an assembl where more than average strength is require

SAFETY PRECAUTIONS FOR SEWING AND TACKING

When making tackings or servings on th pack, remove the canopy and suspension line



ure 5-2.—Lift web tacking on the NC-3 type
rachute. Position container so that lift webs
ss through spaces provided at extreme
ges of container. Using double 6-cord
lon, tack through lift webs at (A) around
ap slot and back through the lift web at (B)
agonally across to (C) through lift web,
ound snap hook and out through webbing at
). From (D) go diagonally across again to
) through the lift web, around snap slot and
ck through at (F). With this free end of the
rd tie a clove hitch at the point where
-C) and (D-E) cross, then back to the
arting point and tie off the free ends with a
rgeon's knot and a square knot.

completely from the pack to prevent sewing the canopy or lines to the pack.

INSERTING PARARAFT KIT

Insert the pararaft kit into its container and engage the releasing mechanism after the loops have been attached to the pack and pararaft kit container. Make certain that the pararaft fits snugly in the container with the use of the two adjustment adapters. The fit should be snug but not so tight as to make removal of the kit difficult. (See fig. 5-4.)

When adjustment of the pararaft kit container has been completed and tackings have been made to hold this adjustment in place, draw the pararaft kit out of the container, and tack the lift web assembly to the parachute container. (See fig. 5-5.)

Pack the parachute, using the same steps as for the NC-3 without the pararaft kit.

Match up the packed parachute and pararaft kit assembly, as shown in figure 5-6, and secure the corresponding loops of the parachute and pararaft kit assemblies, using the 10-inch nylon tie cords.

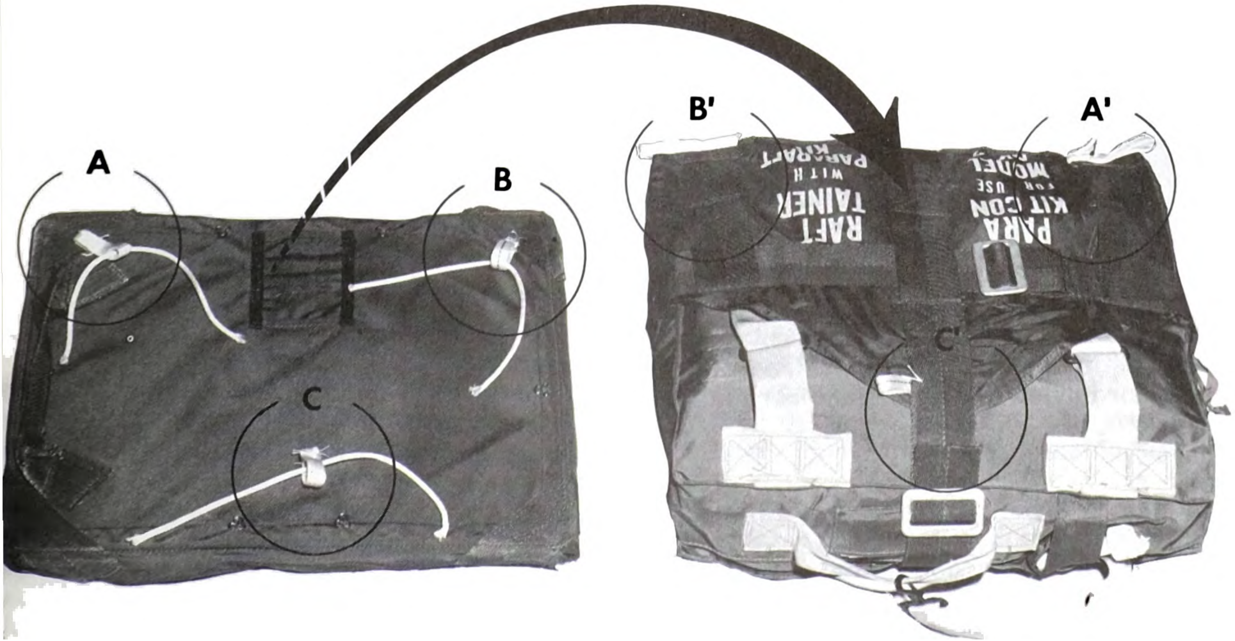


Figure 5-3.—Corresponding securing points between NC-3 pack and pararaft kit container. Using a ''BOX X'' stitching pattern, sew three 3 1/2-inch lengths of 3/4-inch nylon tape (with E nylon thread) to the parachute pack and pararaft kit container at the points indicated in circles, leaving a 1-inch loop in the end of the tape.

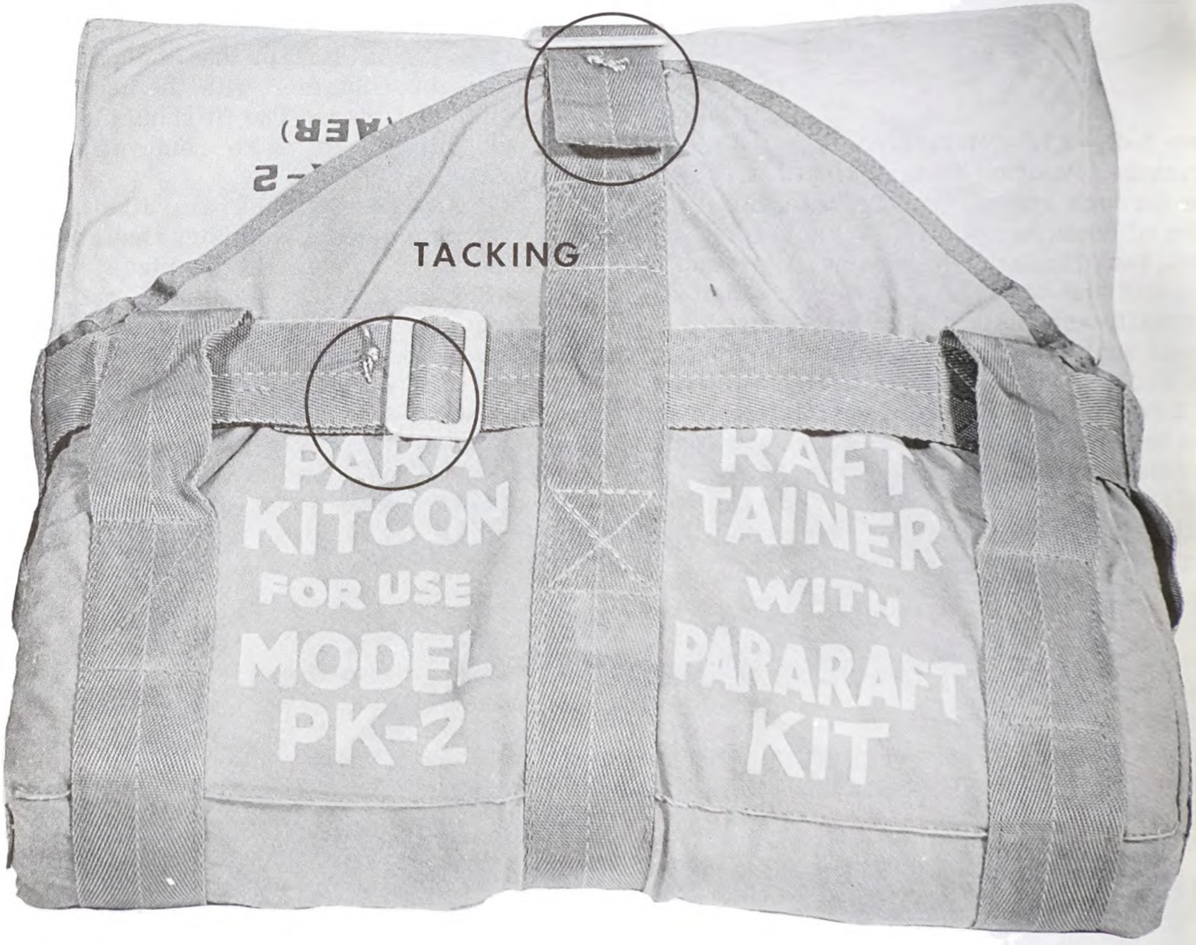


Figure 5-4.—Fit pararaft kit container to the pararaft kit. Adjust pararaft kit container adjustment straps to the desired snug fit and tack each adjustment with one turn of 6-cord nylon (single) behind each adapter.

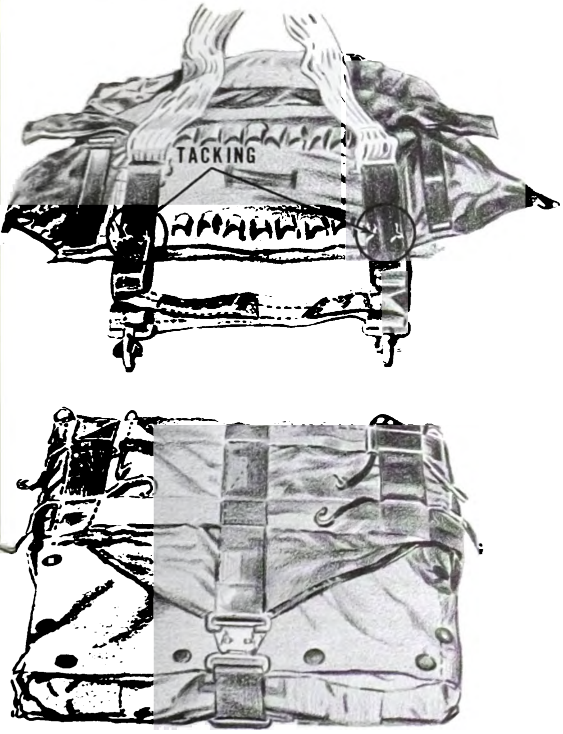
Secure the quick connector snaps to the pararaft kit container, tying them as tightly as possible. (See fig. 5-7.)

RIGGING WITH SEAT PAN

In certain aircraft the pararaft kit to be used with the NC-3 must be contained in a seat pan assembly to conform to the design requirements of the aircraft concerned. In these cases a special modification must be made to the NC-3 harne to facilitate a quick-attachable sling arrang ment for the seat pan assembly. This modificati is described in detail in BuWeps ACSEB 32-6

PACKING THE NC-3

After the parachute has been inspect and all discrepancies corrected as outlined



ure 5-5.—Positioning and tacking procedure r the NC-3 lift web assembly, when rigged ith the pararaft kit. Draw the lift webs out the pack to the point where the chafing ebbing begins. Tack the lift webs at this int—one turn each through the edges of the ebbing and around the pack frame. Use one rn, doubled, size E nylon thread. Tie off ith a surgeon's knot and a square knot.

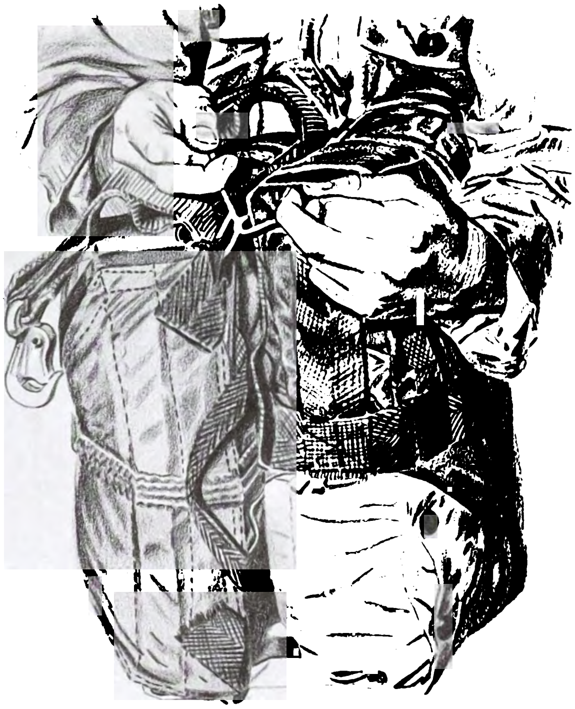


Figure 5-6.—Attachment of pararaft kit container to NC-3 parachute. Tie the pararaft kit container to the NC-3 pack. Draw the two assemblies together tightly with the 10-inch nylon tie cords and secure with a square knot. To hold the knot securely, tack several passes of 6-cord nylon through the knots and tie this tacking off with a square knot.

ipter 3, then aired and dried as described chapter 4, it is ready to be repacked.

The first step is to dust off the packing table. en, grasp the lift web section and hold it at packing end of the table while the helper lls the apex of the canopy toward the opposite l. This will remove the chaining from the spension lines and stretch the chute to its l extend on the table.

Remove dips and/or twists from suspension es and lift web assembly. Attach connector ks to the tensioning hooks (on the packing end the table, as shown in figure 5-1), and engage hook at the opposite end of the table into loop of the pilot chute connector cord at the nt of encirclement of the suspension lines. e fig. 5-8.)

Apply only enough tension at the peak to aighten the chute out on the table. The helper uld then straighten the vent hem by entwining his fingers through the suspension lines and working them (the lines) back and forth through the loop in the pilot chute connector cord until the vent hem is straight. Manipulating the vent hem in this manner will usually straighten both vent hem and skirt hem.

NOTE: It is very difficult to straighten a vent hem when too much tension has been applied.

Check the information found on the nameplate of the canopy and compare with that found on the Parachute Record Card (NavWeps 2743) and the Parachute History Card (NavWeps 2771).

After the vent hem has been properly straightened, apply more tension at the peak. The exact amount of tension necessary for whipping and folding of the canopy cannot be measured, since the tension varies with the personal wishes of the packer. The chute should be tight enough to draw the suspension lines to

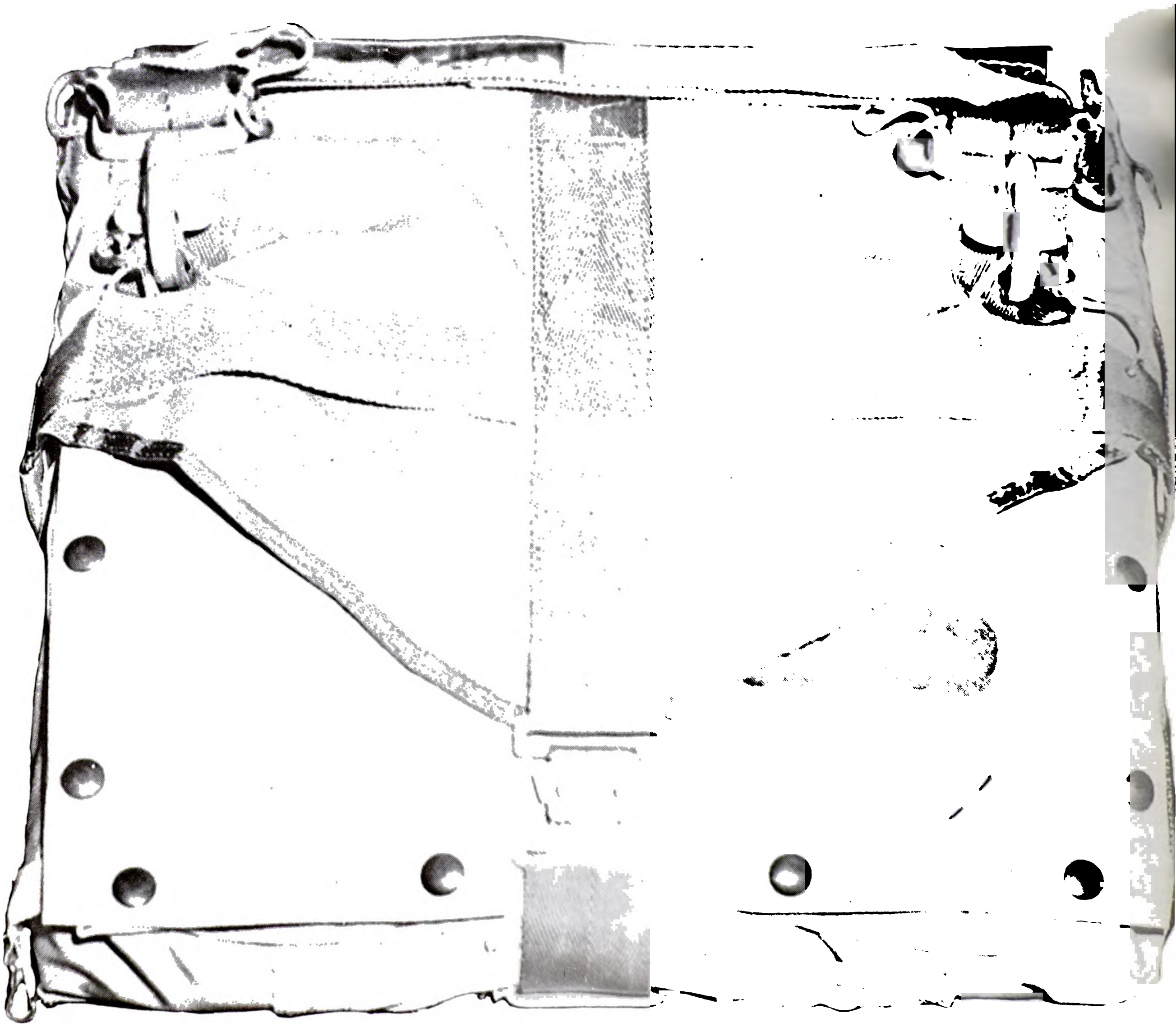
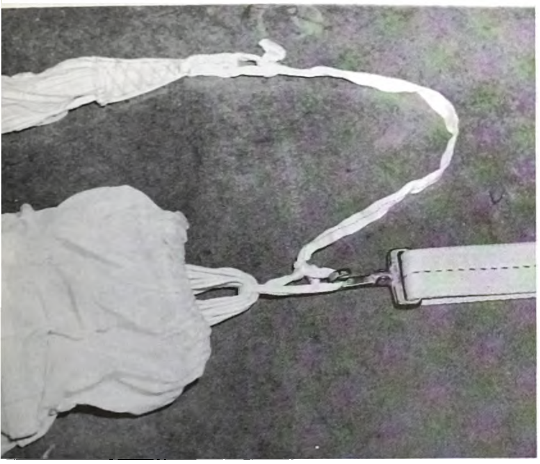


Figure 5-7.—Attachment of connector snaps to pararaft kit container. Insert a 10-inch length of type III nylon cord into each loop and tie the connector snaps with square knots, using these cords.

the center of the table, but not so tight as to be difficult to hold up to shoulder level while whipping and folding the canopy. (See fig. 5-9.) Both members of the packing team should be able to see the entire gore on the inside when the suspension lines are held at shoulder level. This is an instance in which personal experience is necessary to find the tension which suits you most. Practice packing (especially stowing suspension lines and whipping and folding the canopy) until you develop skill and dexterity of movement.

The next step is to whip and fold the canop The packer and helper should work simultaneously from opposite sides of the table the skirt hem. In beginning the whipping an folding, grasp the two top inboard lines and loo back to the links to make sure that the line are free and clear of entanglements. Raise th lines to a level where the inside of the canop can be clearly observed to the peak. Visuall follow the skirt hem to the next suspension line Pick up this line and swing it in a wide arc towar the person on the opposite side of the table



igure 5-8.—Attaching peak of canopy to ensioning device. Do not attach tensioning hook to the suspension lines. This could cause damage to the lines.

igure 5-9.—NC-3 under tension and ready for whipping and folding.

bringing it up to shoulder level and holding it in this position. Look down this line on the inside of the canopy to the peak and make sure that no folds from the previous gore have overlapped the suspension line in view. Repeat this process throughout the canopy until each gore is folded in half and each suspension line is held in place in its proper rotation. Fold each gore until all lines have been taken up by the packing team. When these folds have been made, there will be two gores remaining between the two sets of suspension lines which have not been folded. Stretch the two sets of lines to the outermost edges of the packing table, as shown in figure 5-10. Each member of the packing team should grasp all of the folds at their outer edge and grip them firmly. While holding the suspension lines at the edge of the table, move the folds up and down rapidly in a whipping motion. This motion will assure that most of the wrinkles put into the fabric by the folding action are removed.

To make the last two folds the packer reaches over the suspension lines with his left hand and grasps the center of the top gore, while the helper reaches underneath the lines with his right hand and catches the center of the bottom gore. On a signal, both packer and helper swing their group of suspension lines in an arc toward the center of the table (the packer arcs downward and the helper upward) while at the same time pulling the top and bottom gores to the outer edges of the table. (See fig. 5-11.)

The last fold on the helper's side is made on the bottom of the other folds. It therefore requires special attention in straightening all wrinkles from skirt to peak.

Insert the suspension lines in the slots of the suspension line holder and place a shot bag across the lines to hold them in place. The lines may now be released by both packer and helper. Place a shot bag on the folds of the canopy on the packer's side. Whip all of the folds on the helper's side to the packer's side, except the bottom one. The packer should remain at the skirt hem to hold the folds and suspension lines in position while the helper (starting at the skirt hem) pulls the bottom fold out to its proper position throughout the length of the canopy. NOTE: Do not pull or brush too hard on this fold, or the opposite fold may be disturbed. When the helper reaches the peak, the packer then flips all of the folds, positioned above the shot bag, back to their original position on top of the bottom fold on the helper's side of

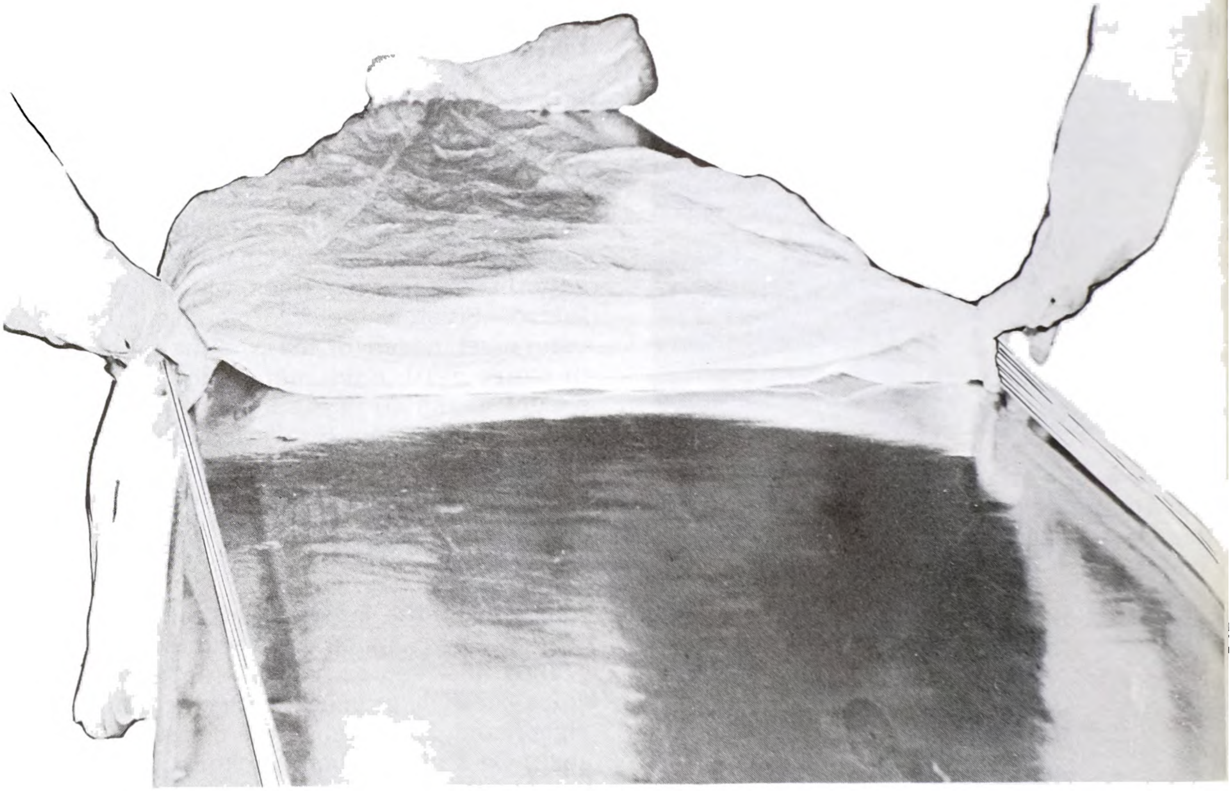


Figure 5-10.—Suspension lines stretched to outer edge of table in preparation for whipping the folds.

the table. The helper then proceeds to brush out any remaining wrinkles in the folded canopy.

Figure 5-12 illustrates the method of folding the skirt hem back in preparation for straightening, and figure 5-13 shows the method of straighening.

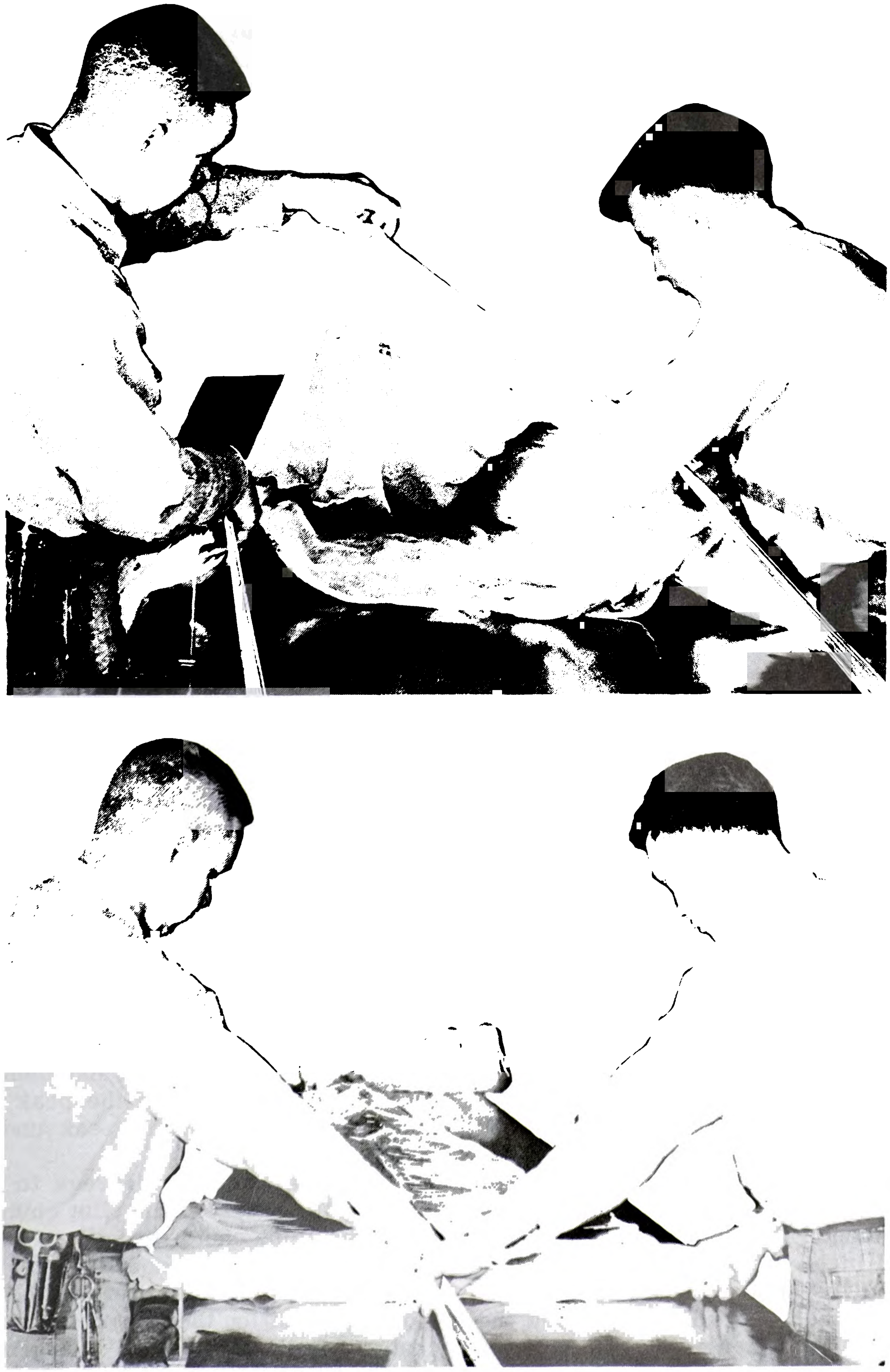
Before stowing the suspension lines the canopy must be folded as shown in figure 5-14.

The packer should sign inside Parachute Record Card while the helper releases the tension at the peak very slowly and carefully. A sudden release might disturb the canopy folds. Unhook the hooks, or tensioning device, from the connector links and prepare to stow the suspension lines. Place pilot chute on top of canopy. This prevents it from falling off the table while stowing lines.

The pack should be as level as possible on the table to provide an even working area when packing the chute. It can be leveled by inserting a wooden leveling block or an old foam rubber seat cushion under the pack and tucking the flaps in around it to hold it in place. By having this added elevation, the packing hook is easier manipulate and the lines are easier to stow the hesitator loops.

Stowing suspension lines consumes mo time than any other step in the packing proces because they must be stowed as straight possible and absolutely free of twists and e tanglements. Stowing them properly requir deft, decisive movements and skill, acquir only by diligent practice. Suspension lin become entangled very easily; therefore, ext caution must be used when stowing to ke them running straight and without tangles b tween the loops. The shot bags are left on t canopy while stowing the lines. This, coupled w drawing only enough line to form the bight bei taken, keeps enough tension on the lines to a in keeping the lines straight.

Once the hook is engaged in drawing a bight the lines through a hesitator loop, do not perm the tip to lose contact with the bottom of the pa This action will prevent "dropping" a line, whi could cause a "line-over" during a descent.



gure 5-11.—Completing last two folds of canopy. (A) Gores being grasped in the center prior to ving suspension lines to center of table. (B) Lines brought to the center and skirt hem folds brought out in the opposite direction.

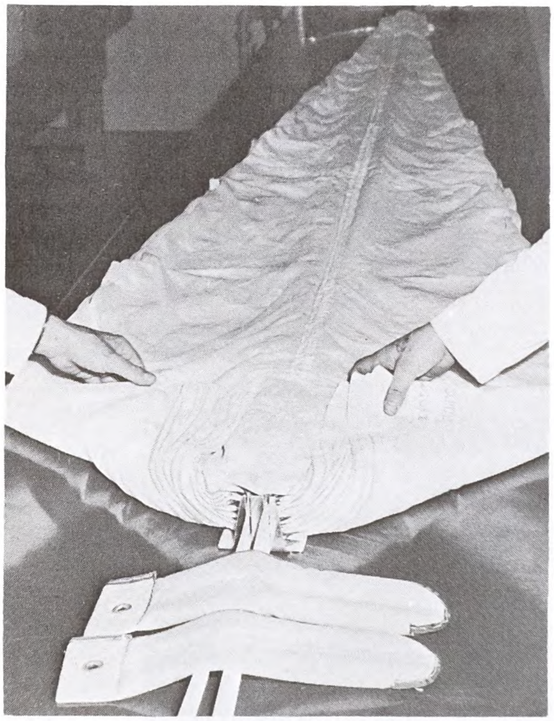


Figure 5-12.—Folding the skirt hem in preparation for straightening. Before attempting to straighten the skirt hem, grasp the folds of the skirt at the corners and fold them back out of the way.

The packer stows the lines while the helper holds the pack steady in the center of the table and assists with the stowing by holding the bights of the suspension lines in place as they are stowed. The proper method of stowing suspension lines is illustrated in figures 5-15 and 5-16. When making the first bight, bring the lines up to the first hesitator loop. This is the loop nearest the helper's left hand when he is in position for packing. Insert a packing hook through the loop from the outside edge of the pack. Engage the hook in the lines and draw them through the loop. The completed bight should extend about 1 inch beyond the loop.

The second bight is made by inserting the packing hook in the hesitator loop directly opposite the first, then carefully estimating the amount of suspension lines needed to make the bight and grasping the lines at this point. Without twisting the lines, lay them up on the container and engage the hook at the point decided in your estimate of length. Pull this bight through the loop. Repeat this process o inserting the bights of lines alternately fro one side to the other until all 16 hesitato loops are filled.

After the last bight has been placed in th hesitator loops, check for twists and droppe lines. Remove all wrinkles from the hesitato loops, using the temporary locking pins as straightening tool. There should be 12 to 1 inches of lines remaining between the skirt he and the last bight taken. This line permit bringing the skirt up to the far edge of the pac (See fig. 5-17.)

Proceed with the packing operation as il lustrated in figures 5-18 through 5-31.

Caution the helper not to hold down or dra back on the long bar while bringing the ski up on the pack, but to follow the motion of th lines. Holding down or drawing back will caus the skirt to tuck under and may pull the las bight of suspension lines out of the hesitato loop.

When the helper is certain that the ski is in position at the edge of the pack and th suspension lines have not been disturbed, h withdraws the long bar and places it on top the folded canopy in preparation for the ne fold. The packer checks the long bar positi for alignment. The bar is held to produce clean fold over the edge of the frame. the bar is held out too far from the edge, th fold will be too long. The position of the lo bar is important to the neatness of the complet pack. The helper uses his left hand to steady th skirt end at the same time that the first fo is made.

As the canopy is folded on the pack, dra the material of the folds about 2 inches beyo all edges of the pack. This will assure a tig pack when the sides and ends are closed.

Another fold is made and then the pack lifts the pilot chute off the peak and the la fold is cast, turning the peak under approx mately 9 inches.

Turn the pack 90 degrees to the left a prepare to compress the pilot chute spring a place the pilot chute directly on top of canop

Fake or coil the connector webbing on top the canopy as the helper prevents the canopy fro slipping. Position the pilot chute directly in th center of the pack and compress it whi guiding the spring in as straight a pattern a possible.

Straighten the folds and corners of th canopy. Work the excess fabric back into th er portion of the canopy. Pay particular ntion to the corners.

When closing the end flaps, do not pound he pack or push the canopy out through the of the container. The end flaps can be ked into position without too much effort by efully shifting the canopy back and forth.

The opposite end is closed in much the same ner. The helper holds the pack steady le the packer pushes excess canopy fabric k toward the center of the pack and smooths protruding portions of the canopy folds. helper then holds the ends of the side flaps n in position while the packer brings up end flaps.

Snap the ripcord protector flap in the closed ition. Sign the Parachute Record Card and ert it in the outside record card pocket. Insert emergency signal code in the pocket on the ss connector strap.

QUICK-FIT HARNESS ADJUSTMENTS

One of the most important responsibilities the Parachute Rigger is the training of sonnel in the use of parachutes and other vival equipment. All naval aviation personnel should know how to don and adjust quick-fit parachute harness and how to k the NC-3 parachute to the harness.

The quick-fit harness is designed to be adted for body length before the aircraft benes airborne. The leg straps and chest straps y be adjusted when needed.

Since the harness is designed to serve as a t or sling to support the wearer during dent, it must be fitted comfortably while the ly is in a seated position. Therefore, all quick-fit adjustments are made either in a sitting or simulated sitting position.

To don the harness, slip the arms between the back straps and the chest straps positioned on each side of the harness. Grasp the main sling on both sides and slide it down over the buttocks to form a sling or seat underneath the body. Sit down in a straight chair, or assume a simulated sitting position by bending forward about 45 degrees, bending at the waist and holding the trunk straight. (See fig. 5-32.)

The harness should fit the body snugly and comfortably lengthwise when in this position. If it does not, remove the harness and adjust for proper body length. This adjustment is made by moving the shoulder adapters--up to shorten or down to lengthen. After adjustment for length, don harness and reassume the original position for donning. While in this position, adjust the leg and chest straps to a snug comfortable fit.

It will be noted that the properly adjusted harness is extremely uncomfortable when an attempt is made to stand erect. For this reason the harness may be worn loosely for comfort while moving about in the aircraft, and quickly adjusted to the wearer when the need arises. This feature, coupled with the fact that the harness may be worn without the parachute being permanently attached, makes the NC-3 parachute desirable for use in aircraft in which members of the crew are required to move about in the performance of their duties.

It is important to stress that personnel should learn to adjust their harness from the stooped position since rarely will anyone have time to look for a seat in which to adjust his harness when the need arises to use the parachute for an emergency descent. A person should be able to don his harness and chute and prepare to jump from any point in the aircraft.

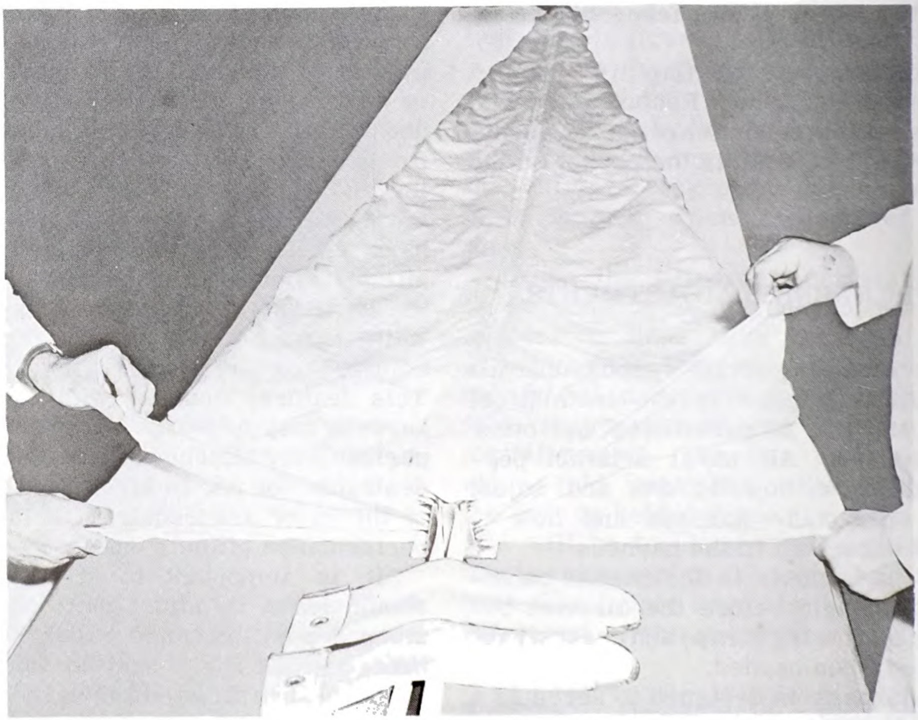


Figure 5-13.—Straightening skirt hem. Align each fold one upon the other until all are nearly place. Count the folds while straightening to be sure that an equal number of folds fall on eac side of the suspension lines.

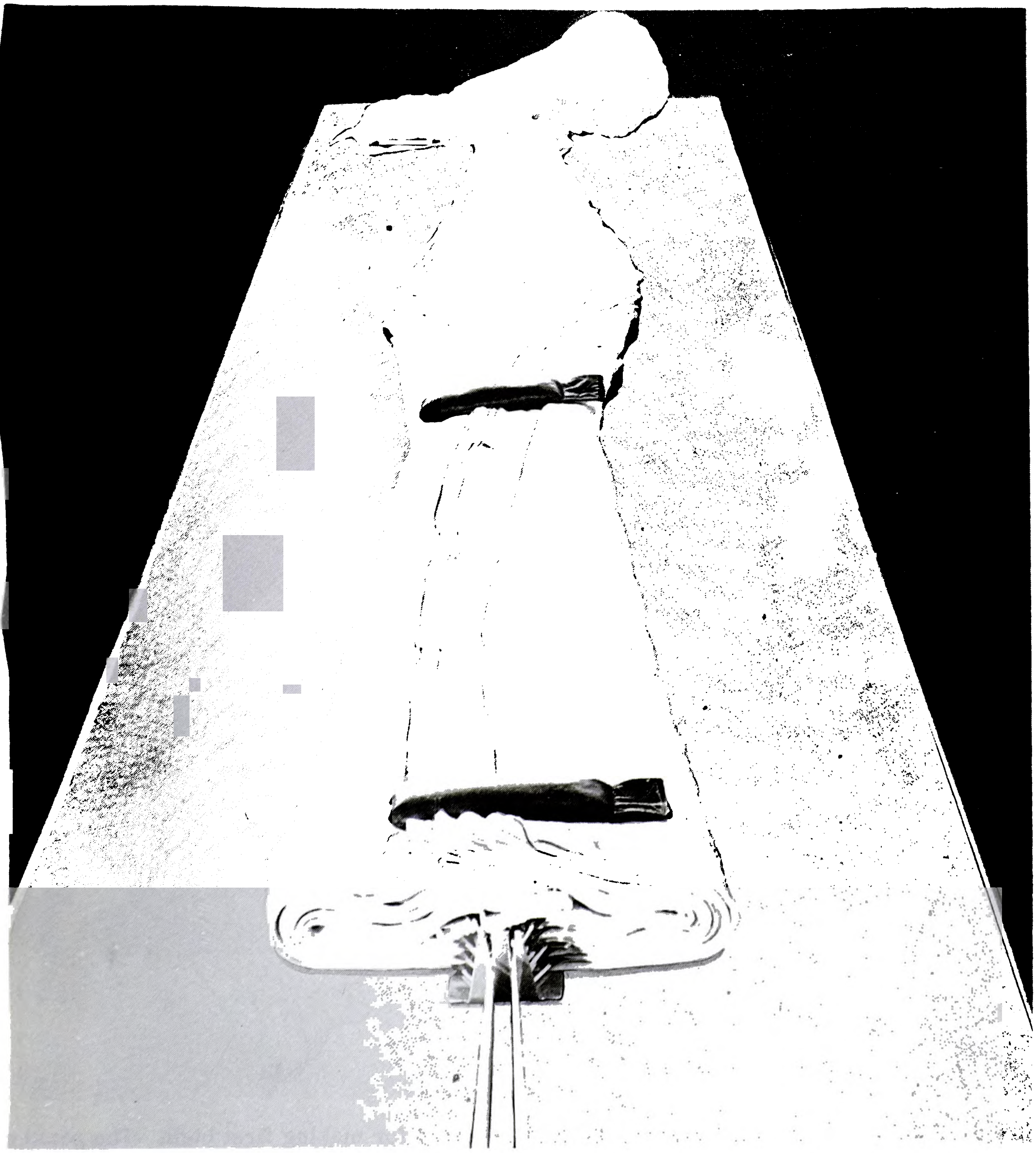


Figure 5-14.—Canopy folded to proper width for making accordion folds into parachute pack. Remove the shot bag from suspension lines and fold the outer edges of the folds in the canopy equally in toward the center to an approximate width of 19 to 20 inches. These folds should extend from the skirt hem to about 2/3 the length of the canopy. Place the shot bags on the canopy—one near the point where the folds "break," in order to hold the folded canopy in place.

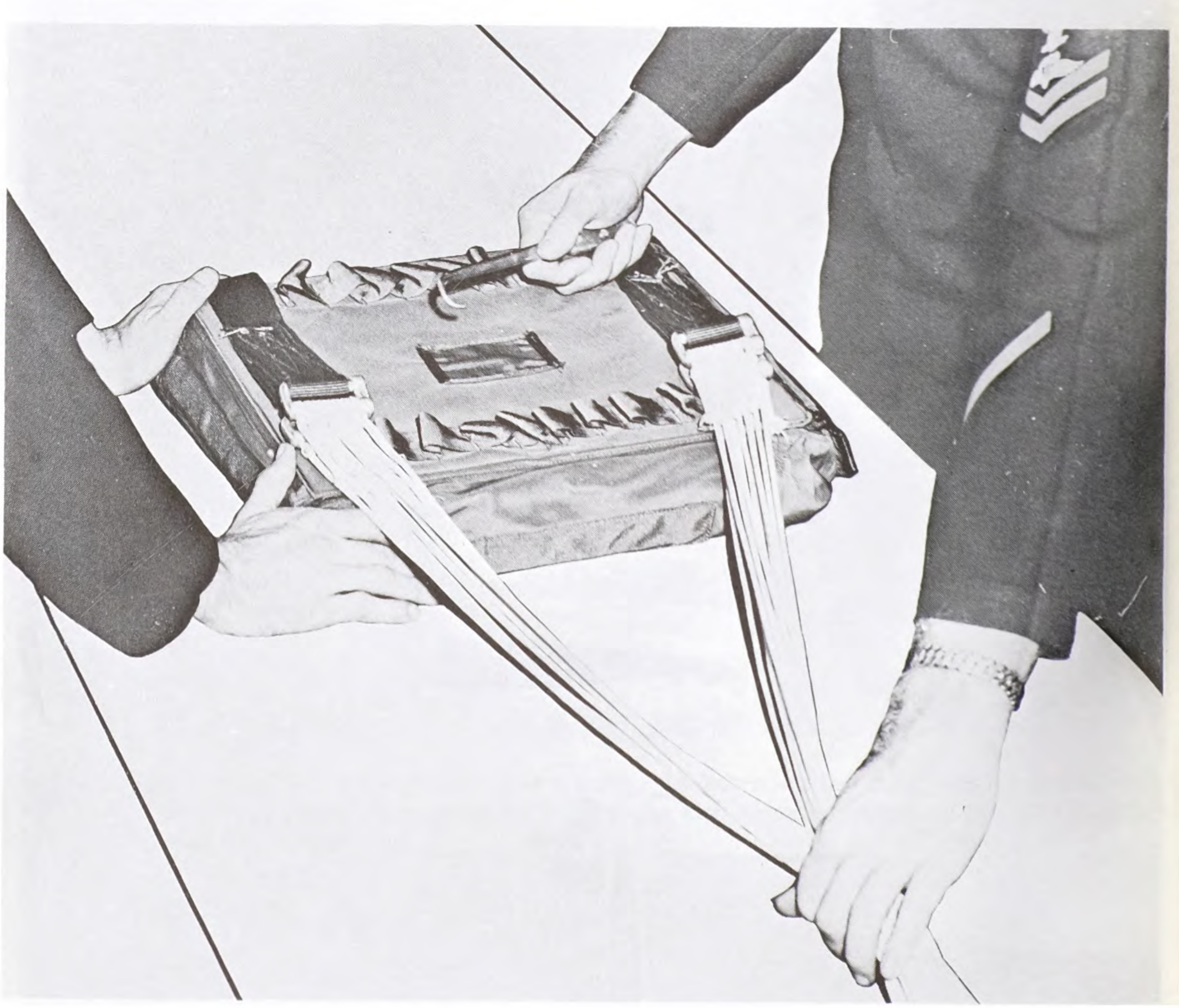


Figure 5-15.—Gaging length of suspension lines required for making first bight. The packer grasps the suspension lines at a point approximately 22 to 23 inches from the connector links in preparation for first bight.

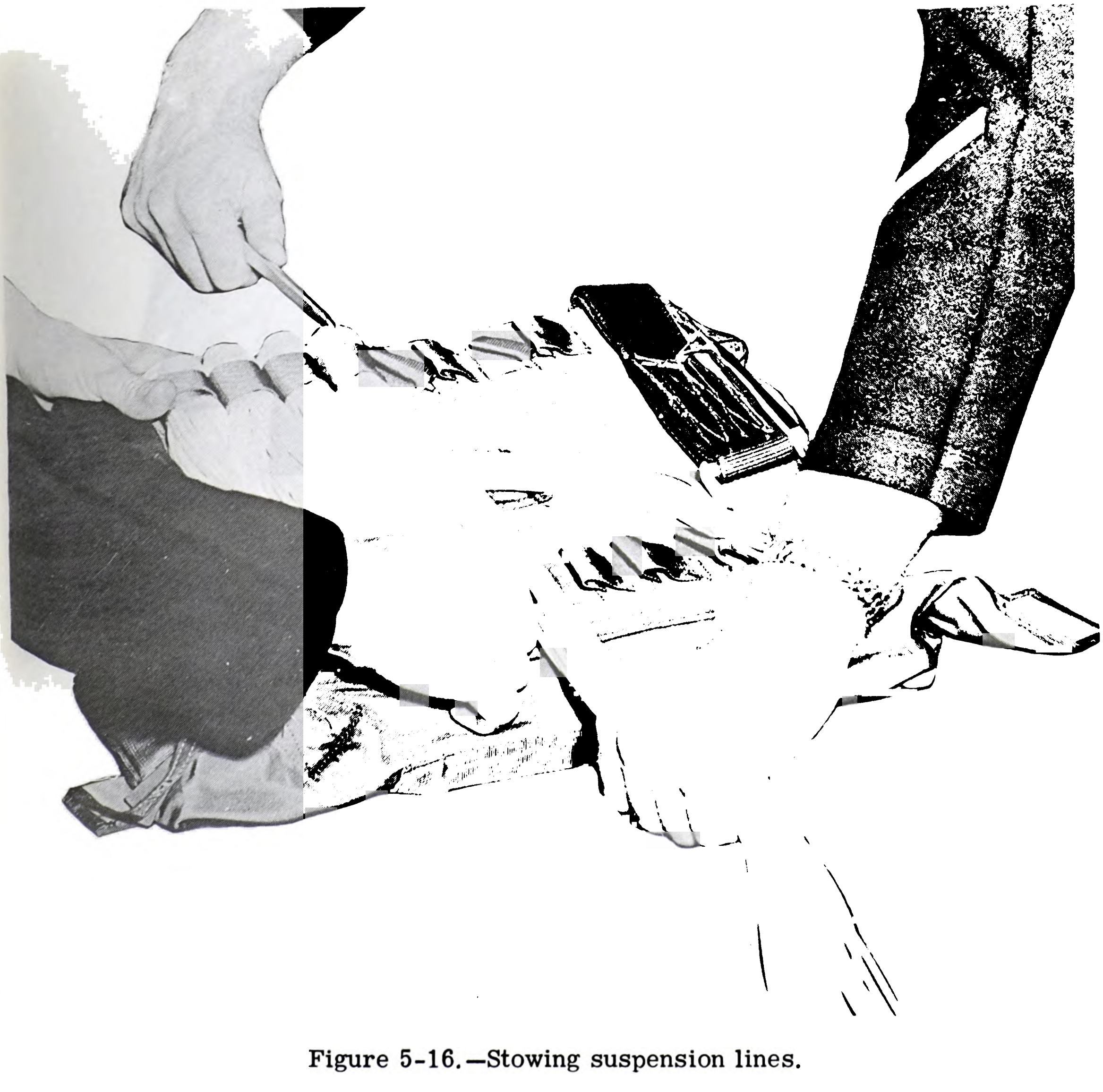


Figure 5-16.—Stowing suspension lines.

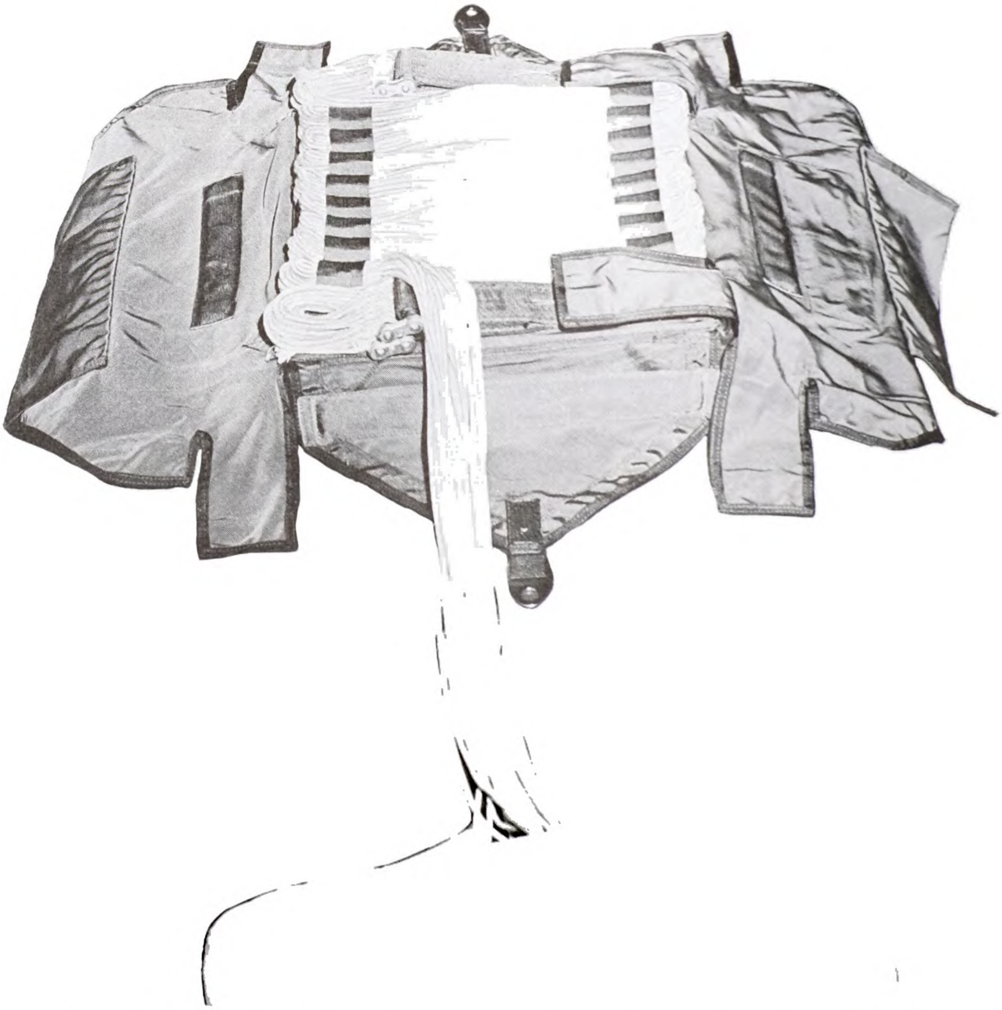
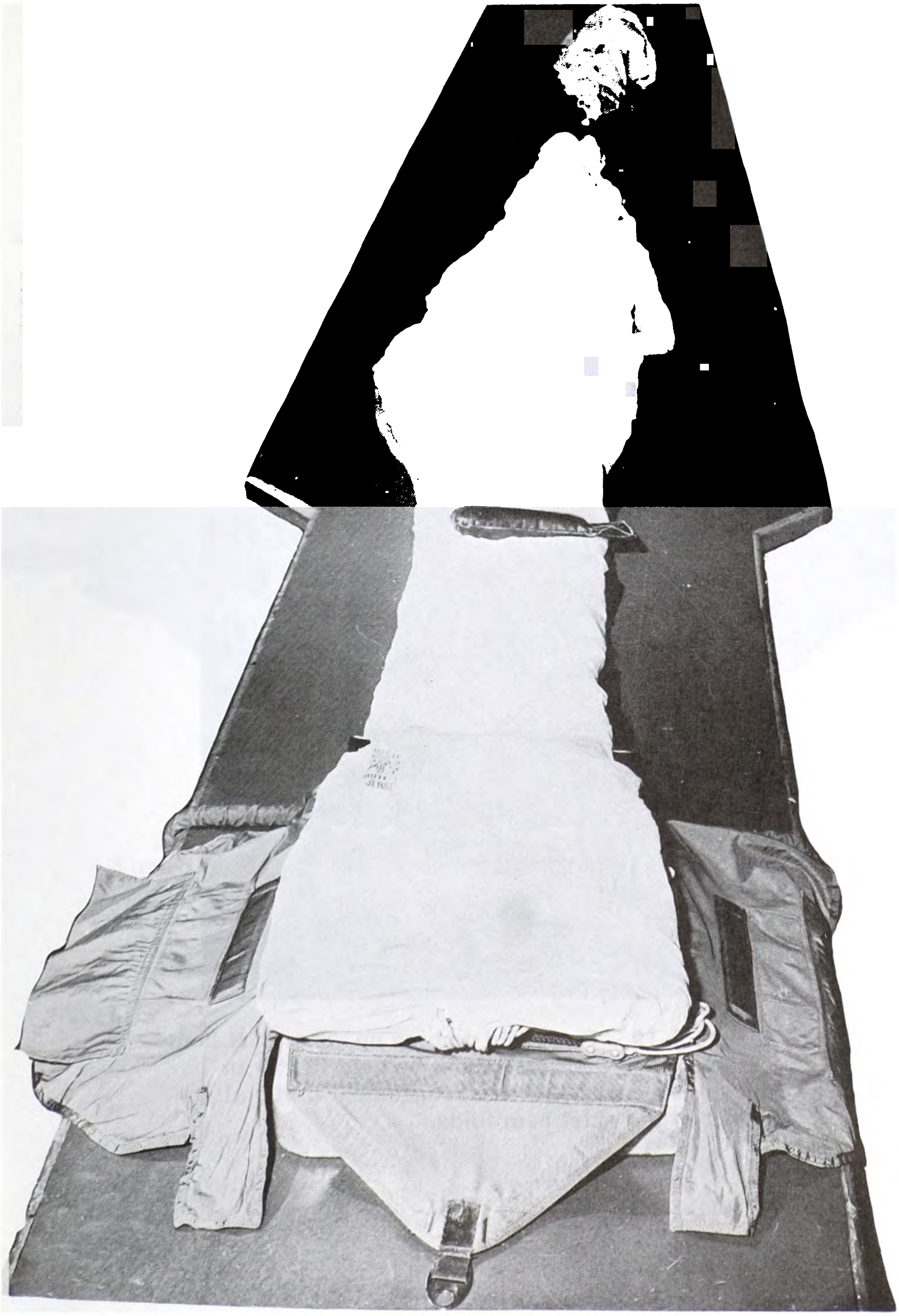


Figure 5-17.—Lines stowed, hesitator loops straightened, and pack turned ready to receive canopy.



ure 5-18.—Skirt of canopy placed on pack. Bring the skirt in a straight line toward the ripcord d of the pack and place the hem directly over the edge, flush with the wire frame of the pack. not permit the free length of suspension lines between the skirt and the last hesitator loop become entangled in the lines already stowed or to project from the edge of the pack.

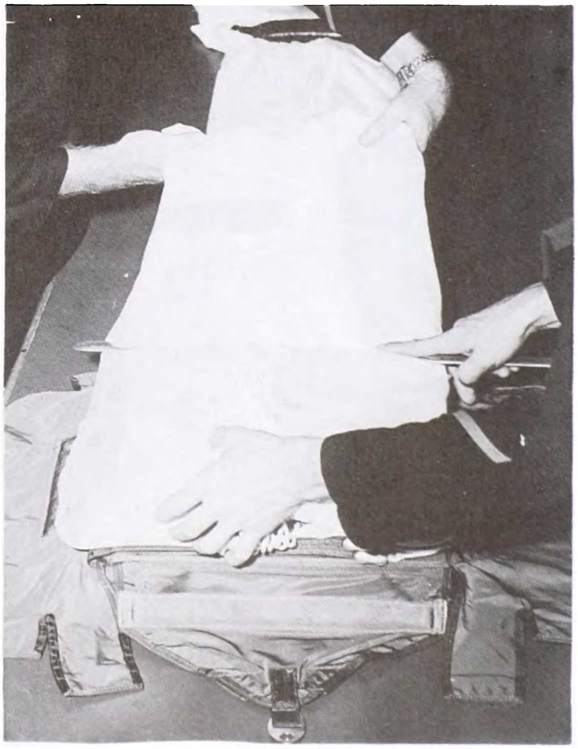


Figure 5-19.—First fold coming up. The skirt hem is bulky and therefore must be held lightly in place to prevent the disarrangement of the alignment of the skirt hem folds.

Figure 5-20.—First fold placed immediately behind skirt hem. Bring the first fold up to a position just back of the skirt hem. This compensates for the bulky hem and provides a relatively flat surface on which the other folds can be made.

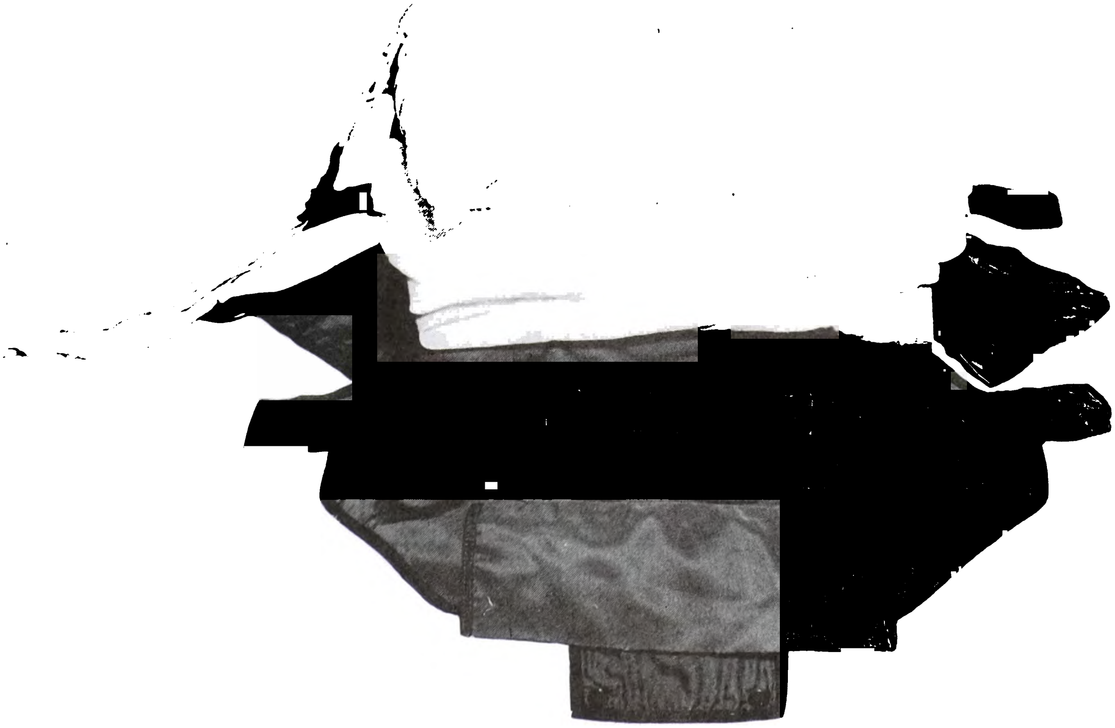


Figure 5-22.—Last fold made and peak turned under; pilot chute ready to be placed on top of canopy.

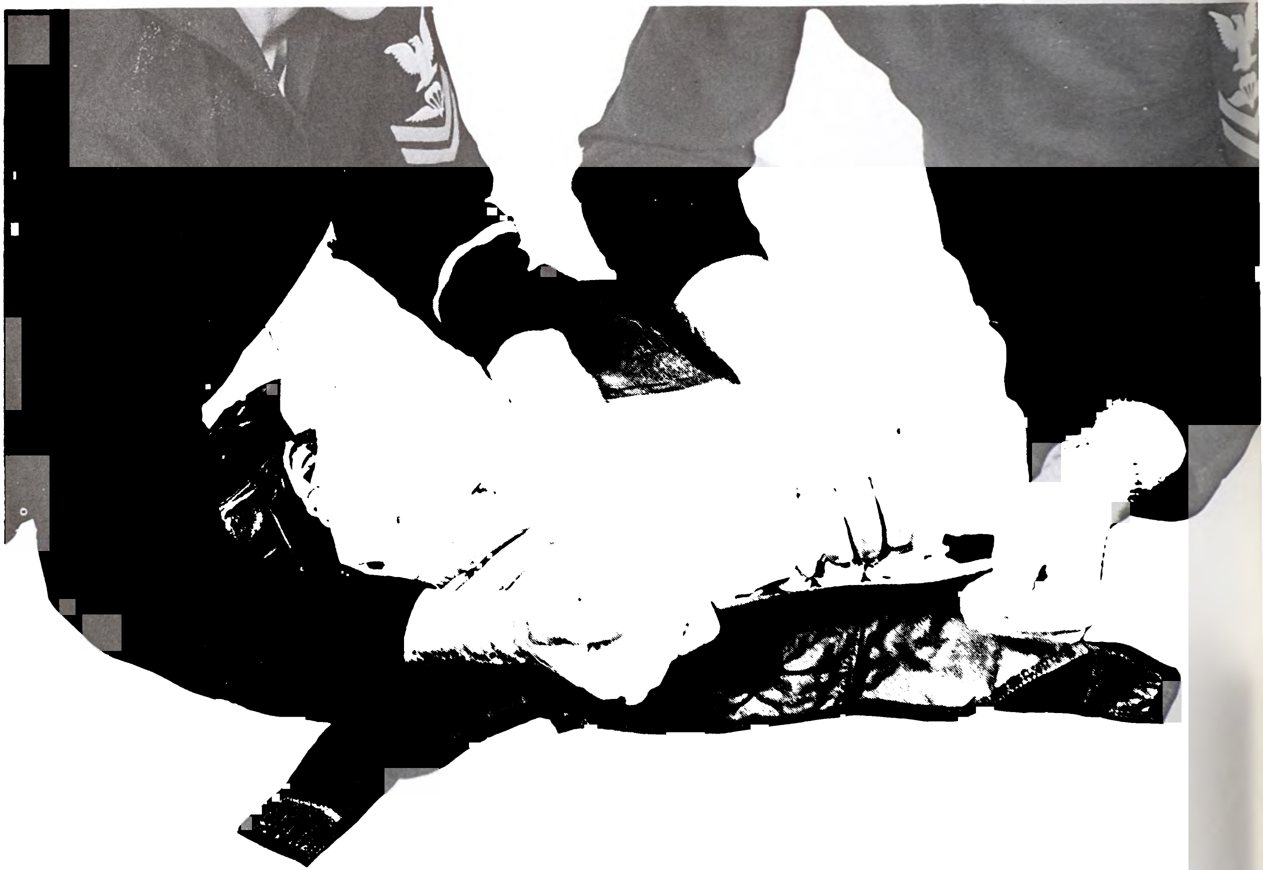


Figure 5-23.—Ready to draw up first side of pack. The packing team holds the pilot chute compressed with their forearms then simultaneously grasps the pilot chute protector flap which is a flap attached to the locking cone side of the pack. As the side is drawn up, keep the fabric from bunching in the center by smoothing down with your free hand between side flap and canopy. Once this side is drawn into position, shift around and pull up the other side while holding the first in place with your arms.

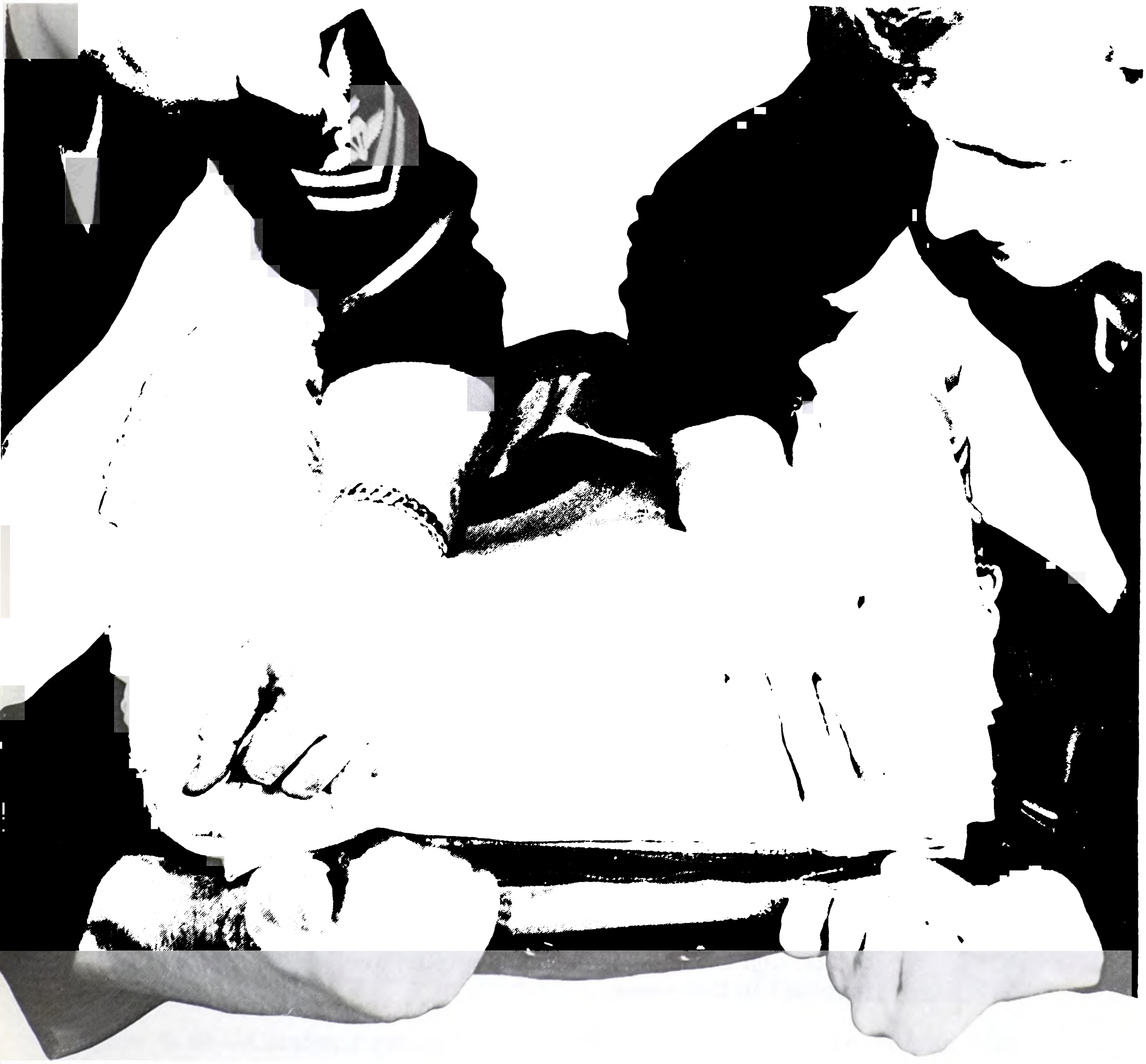


Figure 5-24.—Ready to draw up the second side. Still grasping the pilot chute protector flap attached to the grommet side of the pack, draw the side up to position while keeping the canopy smoothed in place.

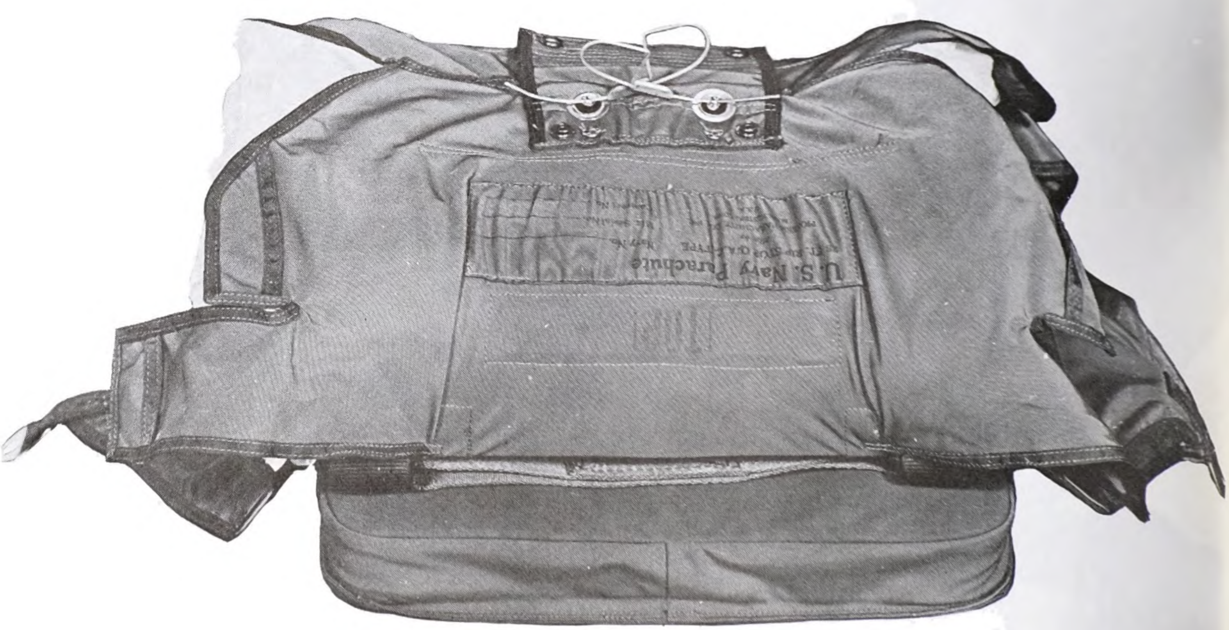


Figure 5-25.—Side flaps drawn up and held in position by temporary locking pins. The grip is shifted, pressure is brought to bear on the assembly, the locking cones are brought into position, the grommets are passed over the cones, and the temporary locking pins are inserted in the cones.

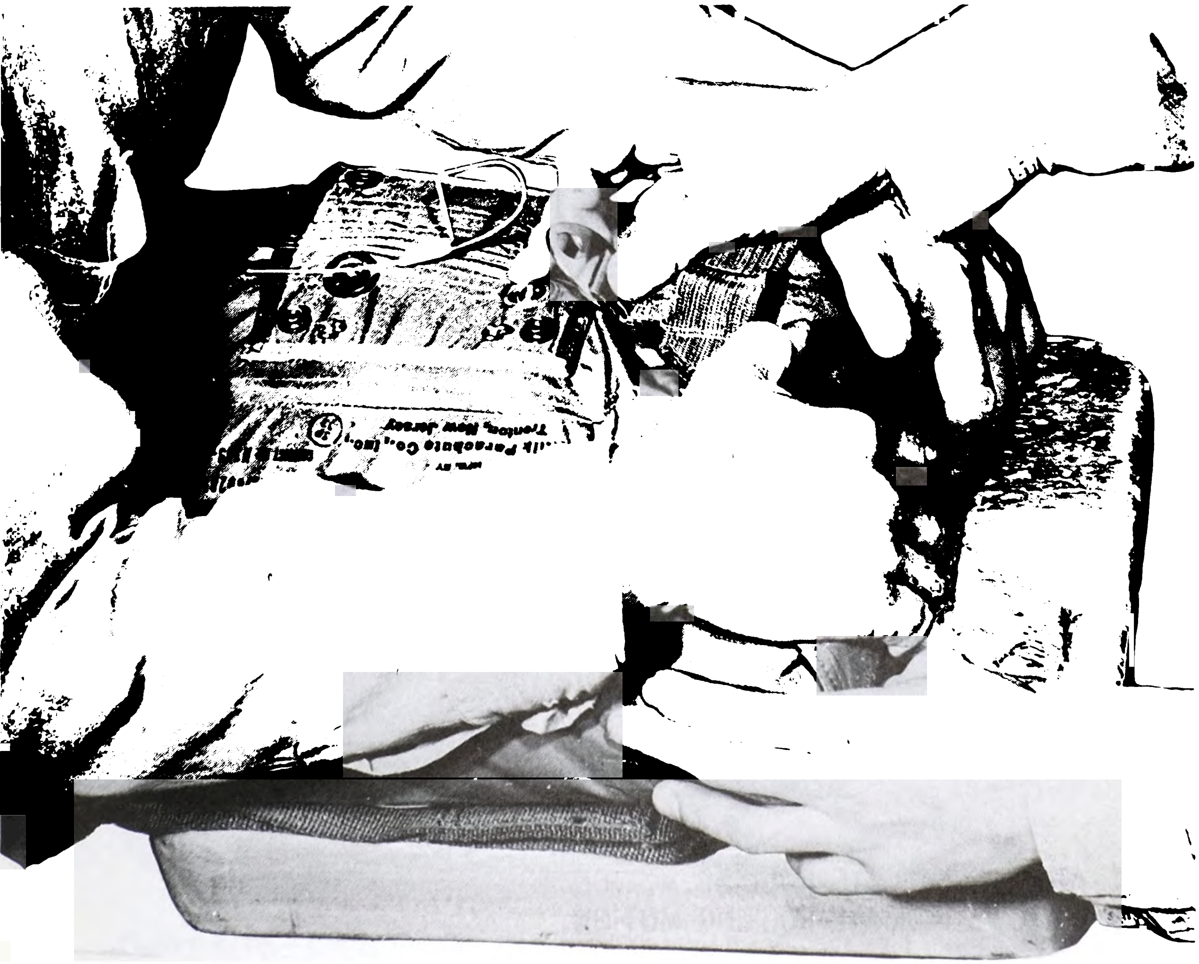
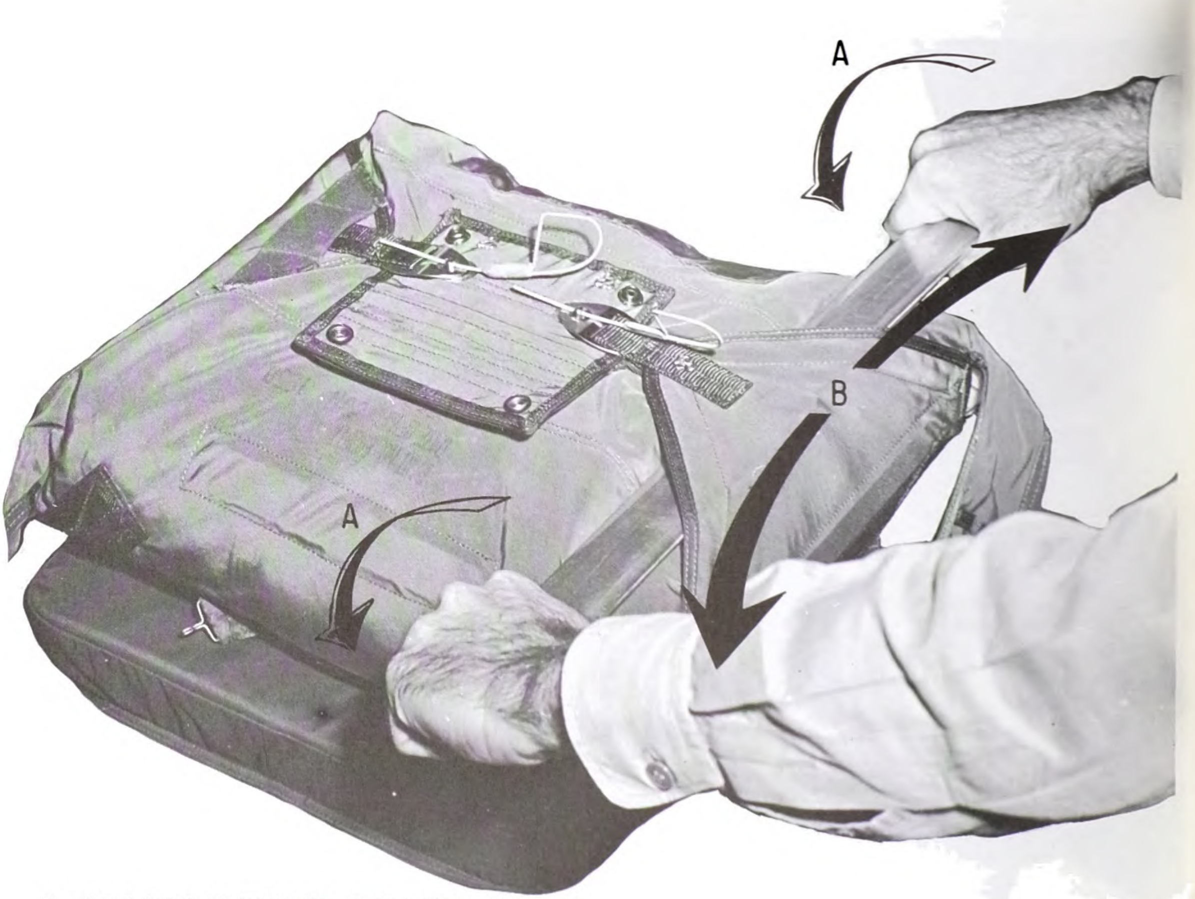


Figure 5-26.—Closing first end flap. Position end flaps (helper pulls up end flap while packer exerts pressure to compress the pack.) Bring end tab into position; remove temporary locking pin and place end tab down over locking cones. Insert locking pin through locking pin hole and over end tab. The temporary locking pin may be removed at this time and replaced with the ripcord. However, it is advisable to use the locking pins until the straightening of the pack has been completed. This will prevent inadvertent opening of the pack while using the bar and fid to smooth out the pack.



A. ARROWS INDICATE ROLLING MOTION
B. ARROWS INDICATE ROCKING MOTION

Figure 5-27.—Sides and ends closed and ready for straightening. Insert long bar under end flaps and straighten container by twisting the bar as indicated by arrow (A) and pulling in a downward motion. Then further shape the pack with a rocking motion as shown by arrow (B). This procedure is repeated on both ends of the pack.

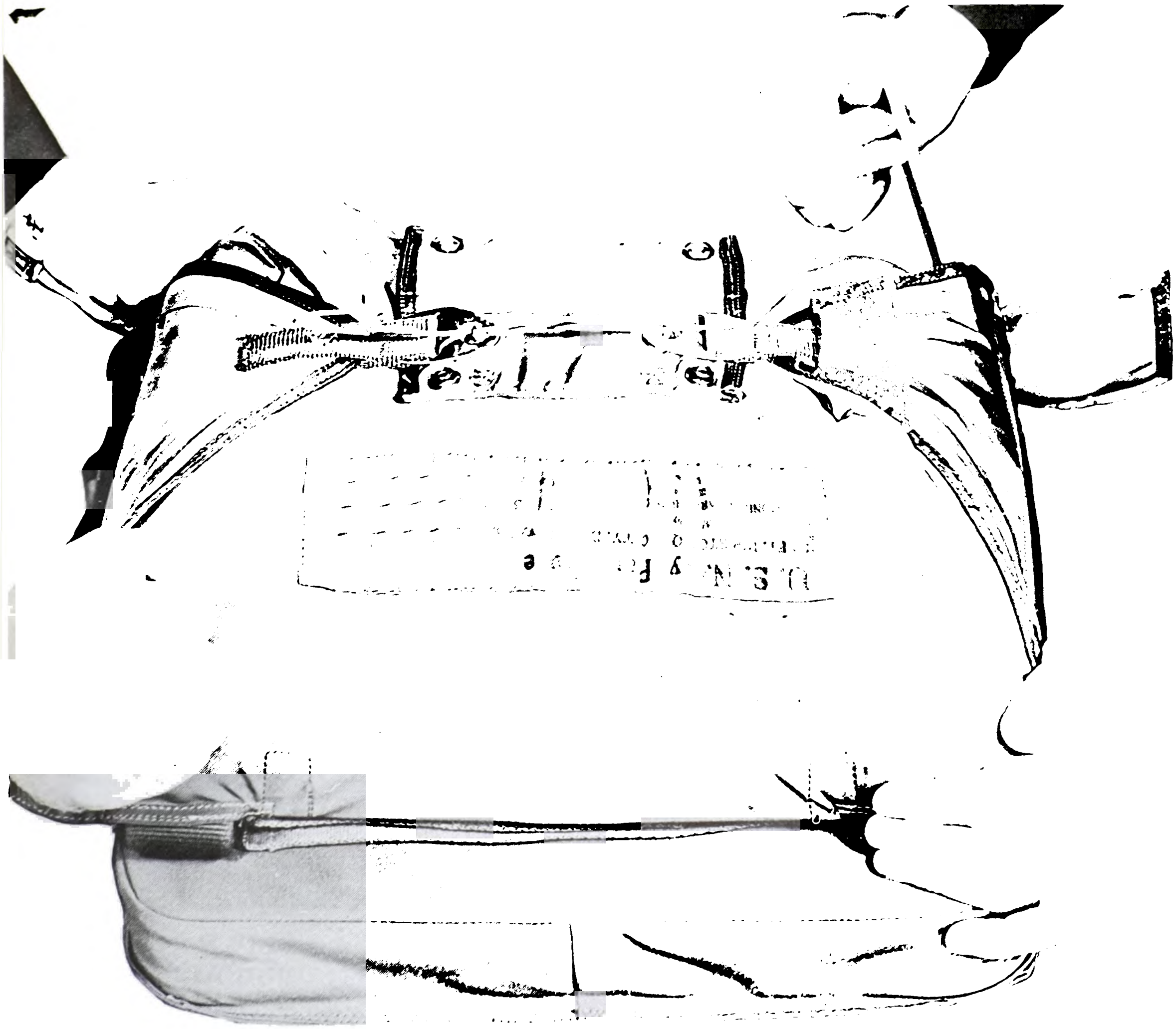


Figure 5-28.—Using the fid. Further straighten the pack and insert the protector flaps with the fid.

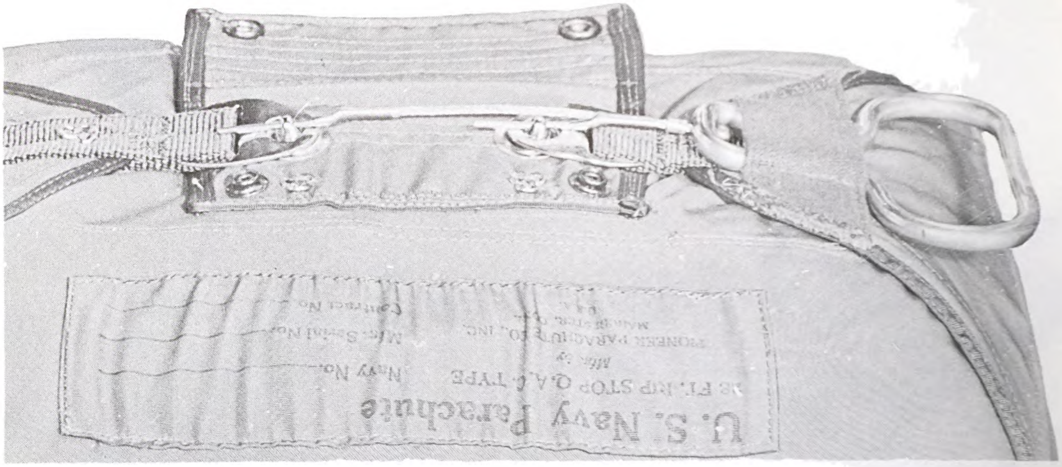

U. S. Navy Parachute
28 FT. RIP STOP Q.A.C. TYPE Navy No.
Mfd. by
PIONEER PARACHUTE CO., INC. Mfr. Serial No.
MANCHESTER, CONN.
U.S.A. Contract No.

Figure 5-29.—Temporary locking pins removed and ripcord inserted.

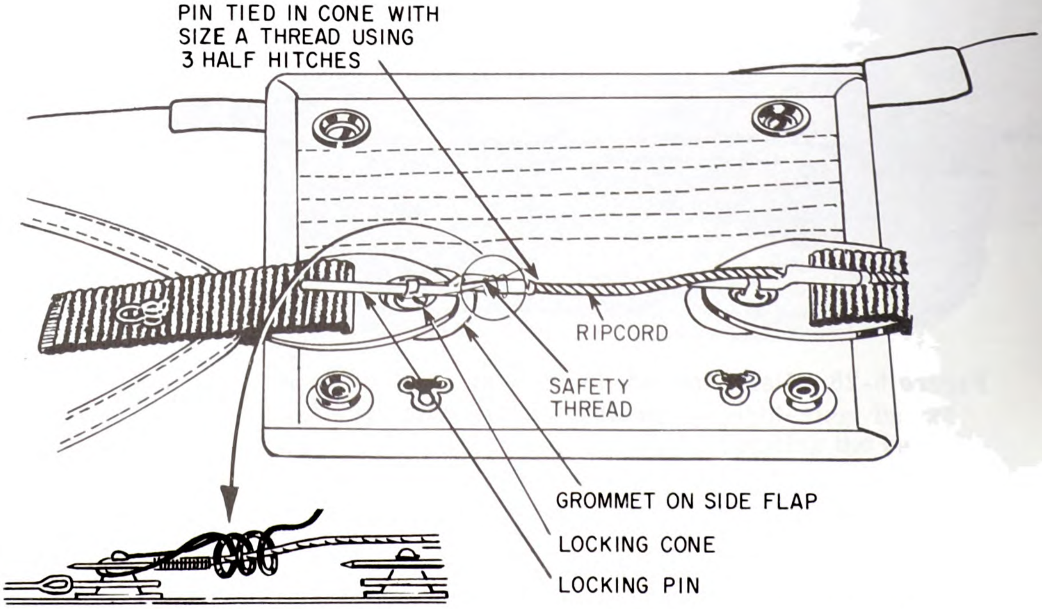


Figure 5-30.—Method of safety tying the ripcord locking pins.

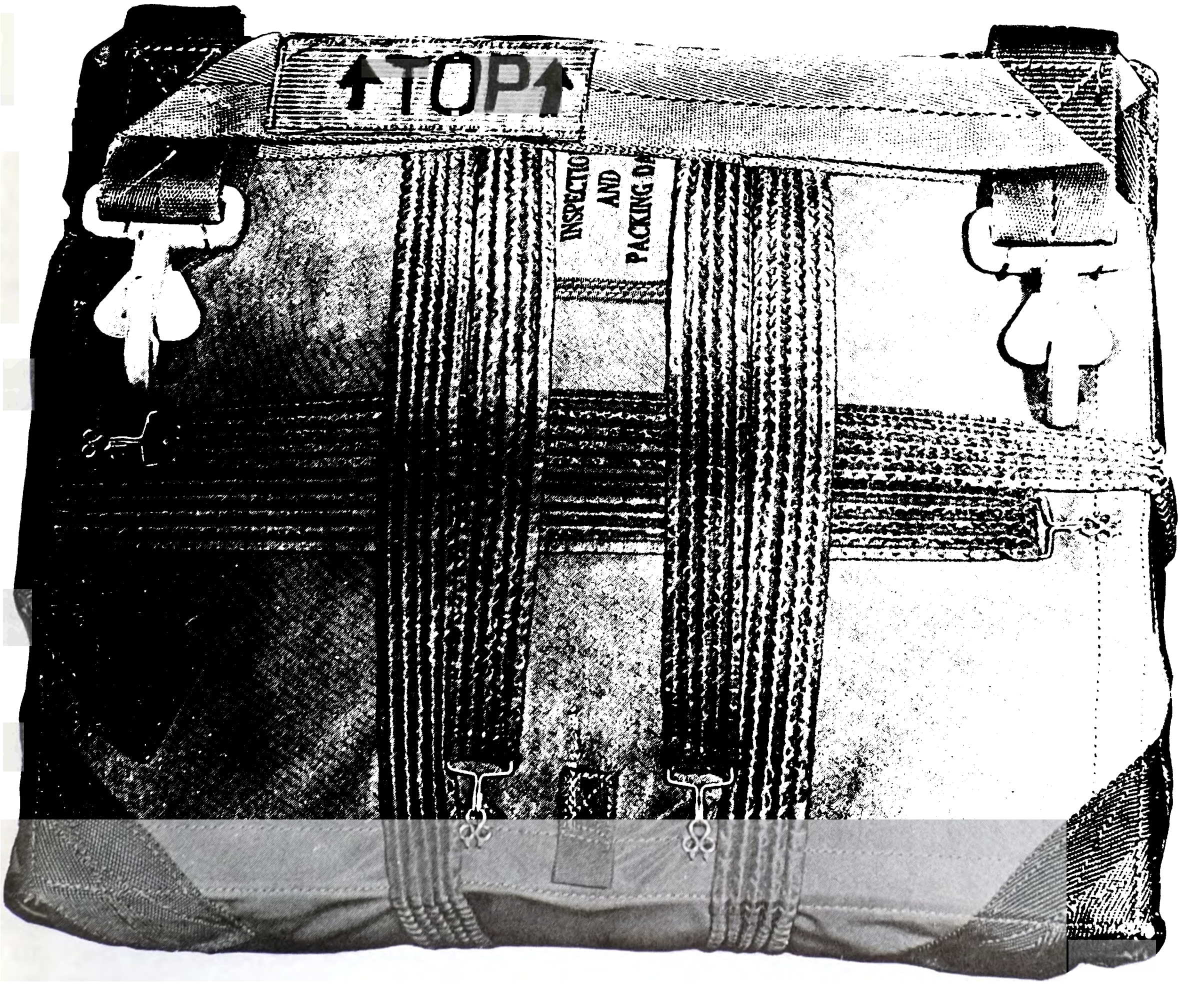


Figure 5-31.—Hook up pack opening bands. Note that bands go underneath cross connector strap.

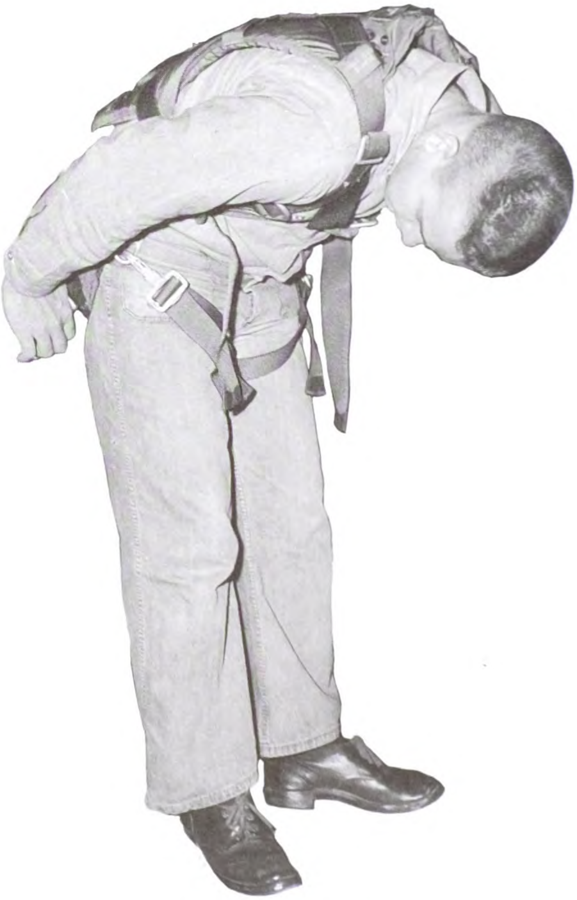


Figure 5-32.—Body in position for donning NC-3 harness.

CHAPTER 6

PACKING AND RIGGING THE SEAT TYPE PARACHUTE

The Navy standard seat (NS) type parachute much the same as the standard Navy chest e (covered in chapter 5 of this course). It, , has a 28-foot ripstop nylon canopy and a ck-fit harness. One of the major differences the two parachutes is that the NS type has a rmanently attached harness vice a detachable e as is the case with the Navy chest type. other difference is (as implied in the nomen- ture of the parachutes) that the seat type is signed to be worn attached to the harness in ch a manner as to form a seat when the wearer in a sitting position. It is normally used in gle-engine type aircraft where the wearer is : required to move around and no ejection at is used.

The same preparatory steps for rigging and cking—airing and drying the canopy, cleaning l otherwise preparing the packing table, ar- nging the tools, and laying out the parachute— ply for this as well as the Navy chest type.

RIGGING THE SEAT TYPE PARACHUTE

The seat type parachute may be used either th or without the pararaft kit attached. To rig completely unrigged parachute without para- ft kit, first straighten the harness and attach back cushion.

TTACHING THE BACK CUSHION

Attaching the back cushion is accomplished positioning both of the diagonal back straps of harness under the center keeper strap near top of the cushion. The risers are then placed der the keepers provided on each side, and the ck strap under the keepers closest to the bot- m of the cushion. Check the keepers to be sure at all are snapped securely in place. Figure 1 illustrates a properly attached back cushion.

CHANGING THE HARNESS

The incorporation of removable connector links makes changing the harness on a seat type parachute a relatively simple task. The procedure involves merely removing the old harness from the connector link and installing the new one.

Removing Harness From Connector Link

Before removing the harness, the entire parachute should be hooked up on the packing table as if ready for packing. Check the suspension lines for continuity, and hook the connector links to the tensioning device. Straighten the new

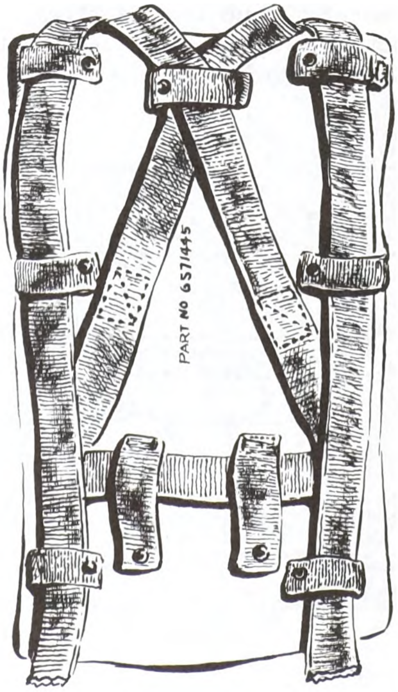


Figure 6-1.—Back cushion attachment for the NS-3.

harness and attach the back pad. Place the new harness in position to be attached. Loosen the screw in the removable end of the link, remove the end, being careful not to disturb the suspension lines, and slide the old harness lift web off the link. Slide the corresponding lift web of the new harness onto the link, replace the connector link assembly removable end, and retighten the screw. Repeat this procedure for the remaining three lift webs. As the last step in changing a harness, recheck the lines for continuity, as outlined in chapter 4, and check the harness to make sure that it is straight.

ATTACHING THE PARACHUTE PACK

Attach the pack by inserting the pararaft retaining straps through the slots provided on the sides of the pack. Make sure that the leg straps face the forward edge of the pack, and pull the retainer straps through the slots as far as they will go. As the retainer straps are pulled together on the inside, line up the centerline of the main sling with the center of the pack. This will assure that the leg straps are in proper position, and that the lift web slots will be in position to receive the lift web assembly.

Insert the free end of the retainer strap through the adapter, draw the retainer straps up snugly, thereby removing all slack. Tack this adjustment with two turns of 6-cord nylon thread on each side of the retainer straps at the point where they pass over the wire frame of the pac Make a tacking on each side of the adapter an at the free end of the retainer strap. All tacking are to be made through both retainer straps. (Se fig. 6-2.)

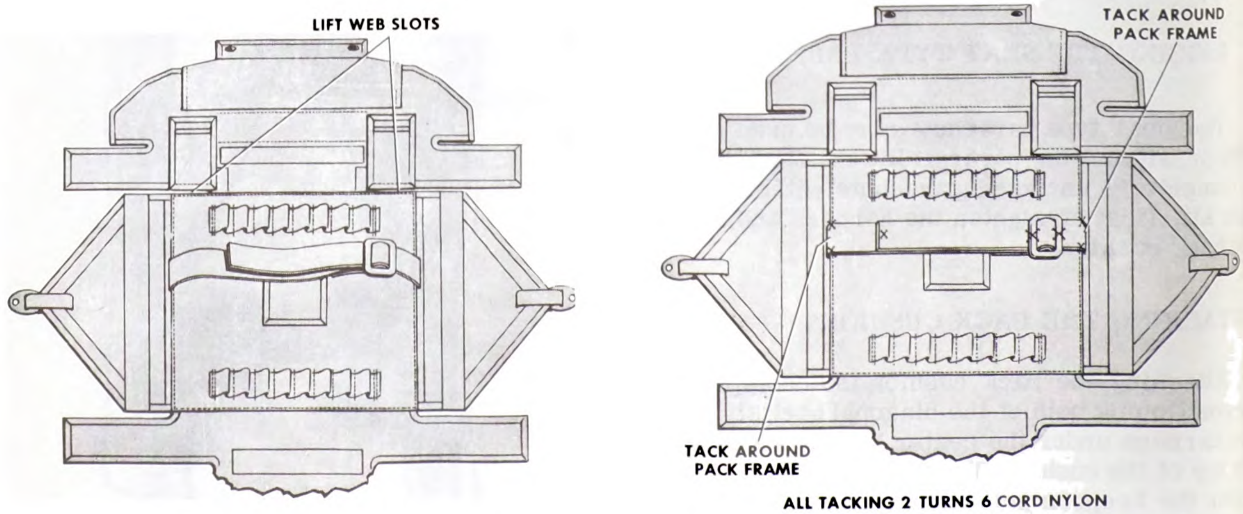
Attach the pack opening bands at this poin and pinch the ends of the hooks closed to pre vent loss. NOTE: The seat cushion is tacke too close to the pack to facilitate attachment the bands later in the rigging process.

ATTACHING SEAT CUSHION

Draw the leg straps through the slot pro vided in the cushion, with the narrow section the cushion to the front. Tack the cushion to th pack using two turns of doubled 6-cord nylo thread through the pack and around the wir frame at each of the four corners. Position th lift webs in the slots provided and tack on eac side with one turn of doubled E nylon threa

ATTACHING RIPCORD HOUSING

Close the pack and fold the ripcord protecto flap over both locking cones. Place the end ta on the ripcord end of the pack over the lockin cone, then fold the protector flap over the en tab. Make a thin but legible pencil mark on th end tab along the edge of the protector flap. (Se fig. 6-3.) Insert the ripcord housing through th sleeve located on the end flap, and draw the en



(A) Retainers entered into pack.

(B) Retainers drawn up and secured.

Figure 6-2.—Tacking raft retainer straps to pack.

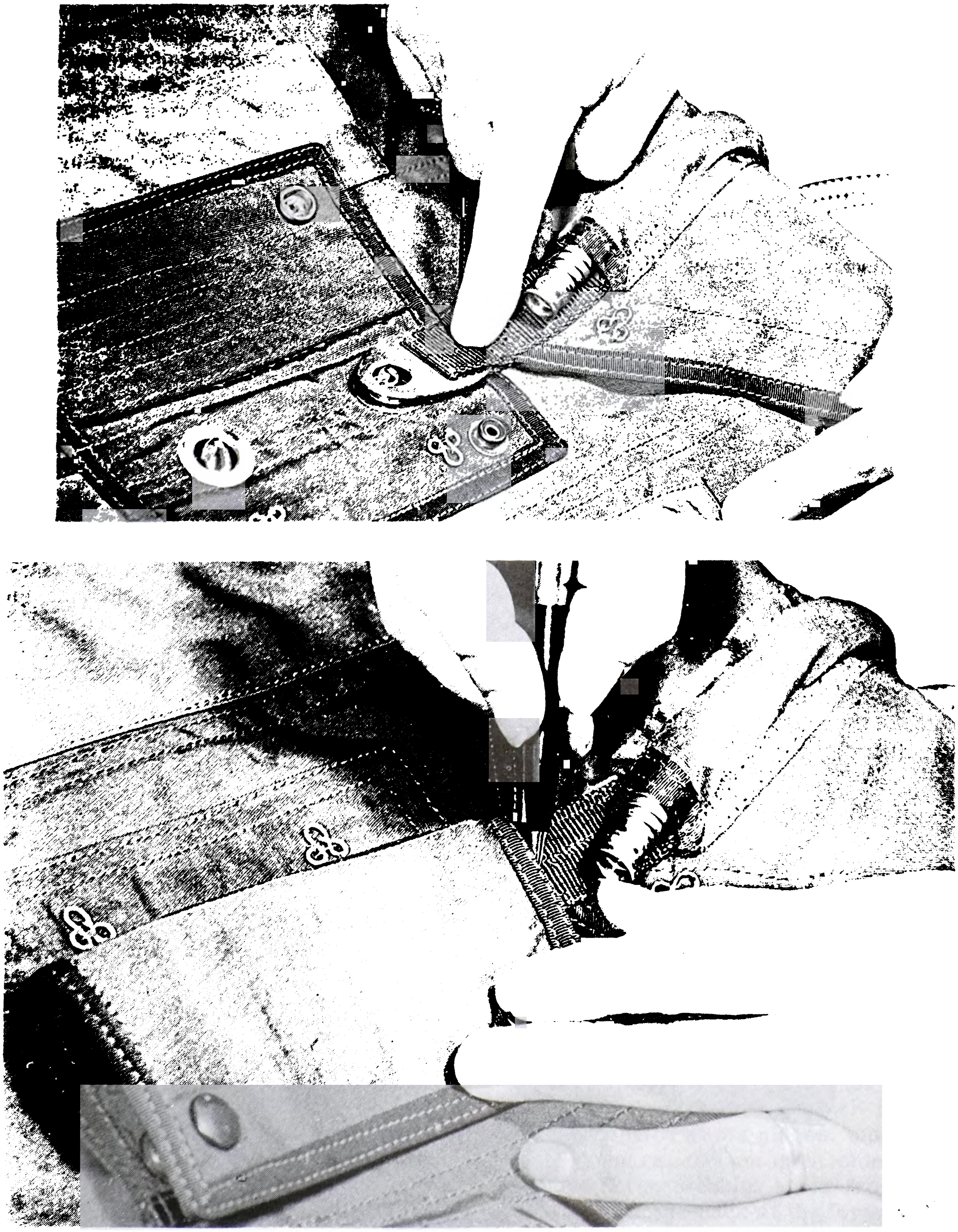


Figure 6-3.—Marking the reference point for attaching ripcord housing. (Top) End tab placed over cone; (Bottom) flap in position.

ferrule up to a point one-eighth inch from the reference point previously marked on the end tab webbing. Hand sew around the ferrule and through the end tab webbing with eight turns of 6-cord nylon thread. Do not complete attachment of the ripcord housing until after the parachute has been fully packed.

Upon completion of the packing, reeve the housing through the sleeve on the harness, parallel to the main sling, under the leg strap webbing, and over the chest strap. Extend the harness as shown in figure 6-4. This is done to remove any slack from the harness. Mark a reference point on the harness webbing at the end of the ripcord housing, with the housing compressed. Tack the end ferrule of the ripcord housing with eight turns of 6-cord nylon thread. Tack again with four turns of 6-cord at the point on the edge of the webbing at the V formed by the extension of the diagonal back straps to form the upper section of the leg straps, and once more just below the point where the housing goes over

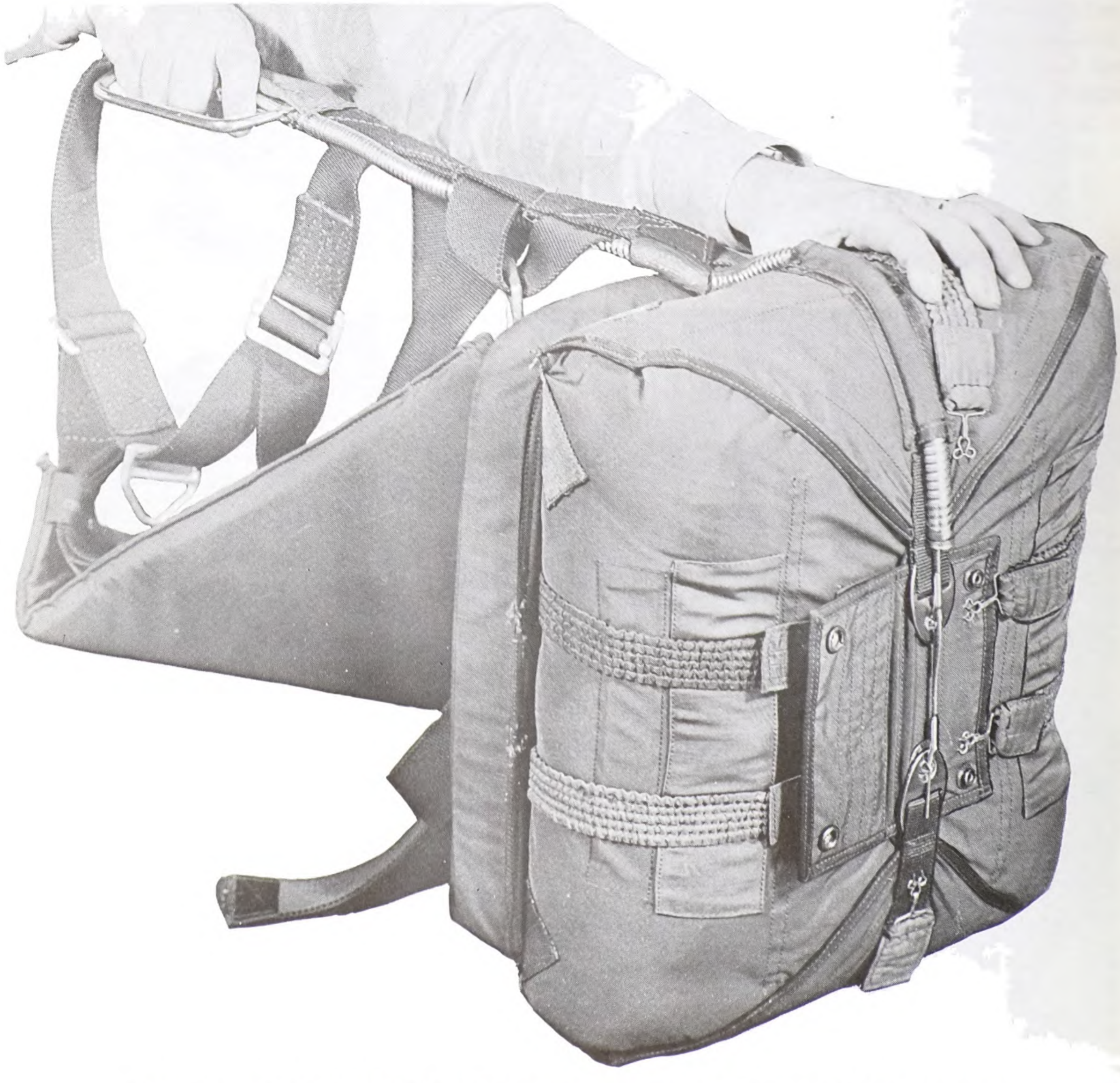


Figure 6-4.—Checking the NS-3 for susceptibility to premature opening.

chest strap. Insert the ripcord handle into
grip pocket and position the pocket at the end
ie ripcord housing. Grasp the harness through
ripcord handle, around the grip pocket, and
nd once more to make sure that the ripcord
iot be inadvertently pulled. If this check
ves that the ripcord grip pocket is properly
itioned, tack the pocket in place with a run-
; stitch, using 6-cord nylon thread. Ripcord
pocket tacking must be done with the handle
alled in the pocket to assure that adequate
m is left for installing the handle and yet
igh grip remains to hold the handle in the
ket after installation. Upon completion of
ing, remove the handle to check the elastic
of the pocket. Figure 6-4 illustrates a prop-
attached ripcord assembly and demon-
tes the method of checking for proper
chment.

RIGGING WITH PARARAFT

Attaching the pararaft kit to the seat type
.chute is a step in the rigging process. There
io change in the flat packing method, as this
he standard method of packing all seat type
ichutes. Any seat type parachute is con-
ered unacceptable for issue if it fails to pass
pack thickness gage check. This is especially
ortant when it is rigged with the pararaft kit.
The rigging procedures for the pararaft kit
as follows:

1. Place the pararaft kit in the pararaft kit
ainer and fasten the release mechanism.

2. With the aid of the two adapters, shown in
re 6-5, make certain that the kit fits snugly
s container and yet is not so tight as to make
oval of the pararaft kit difficult in an emer-
y. Tack each adjustment with two turns of
rd nylon thread, single, to prevent slippage.
ition these tackings through the free ends of
webbings, close to each adapter. Sear each
of the cord to prevent raveling and tie off
a surgeon's knot and a square knot.

3. Remove the canopy and suspension lines
n the pack and either stow them in a chafing
or simply lay them aside on the table. Cut
lift web tackings and remove the lift webs
n the pack. Remove the ripcord grip pocket
the ripcord housing from the harness. (Leave
sing attached to pack.) Remove the seat
ion.

Cut the securing tackings holding the retain-
straps. Slip the retainer straps out of the pack slots, completely disengaging the pack from the harness. Cut the remaining tackings, holding the lift webs in the pack. The parachute is now ready to be rigged with the pararaft kit.

4. Position the harness and pack in the correct attitude. Run the pararaft retaining straps through the side web loops (or keepers) of the pararaft kit container and through the pack slots, as shown in figure 6-6, with the female portion of the quick-release snap on top. The snap side should face out and up.

Pass the free end of the webbing through the adapter, which has been passed through the webbing keeper in the pararaft kit container and the pack slot.

Draw the two containers together snugly, removing all excess slack in the retaining straps. Tack as shown in figure 6-2.

The opening bands should be attached to the pack at this point; check to see that this has been done. Pass the leg straps through the keepers in the top of the pararaft kit container and reinsert the pararaft kit.

5. Lay the pararaft kit and container flat on the pack. Line up the rear edge of the pararaft kit container along the rear edge of the pack. If the pararaft kit protrudes over the front edge of the pack, compensate for this condition by shifting it slightly beyond the rear edge. An extreme condition of protrusion will require repacking of the pararaft kit. Straighten out any wrinkles or doubling under of the material of the container. Recheck the alignment of the container and pack. Make a visible mark with a light colored crayon or pencil at each tacking point on the parachute pack. After checking the relative sizes of the parachute pack and pararaft kit container, an experienced Parachute Rigger may omit marking the tacking points.

6. The task of making the necessary tackings to the pararaft kit container is made easier by the removal of the kit from the container before beginning the tackings. Removal also prevents piercing the kit with the needle. The tackings are made with one turn of single 6-cord nylon thread through the kit container and around the pack frame. The kit container is tacked to the parachute pack at six places: one on each of the rear corners, one on each side of the quick-release fitting webbing at the front, and once on each side of the pack at the forward edge of the kit container. (See fig. 6-7.) CAUTION: Do not tack through the webbing, but through the container on each side.

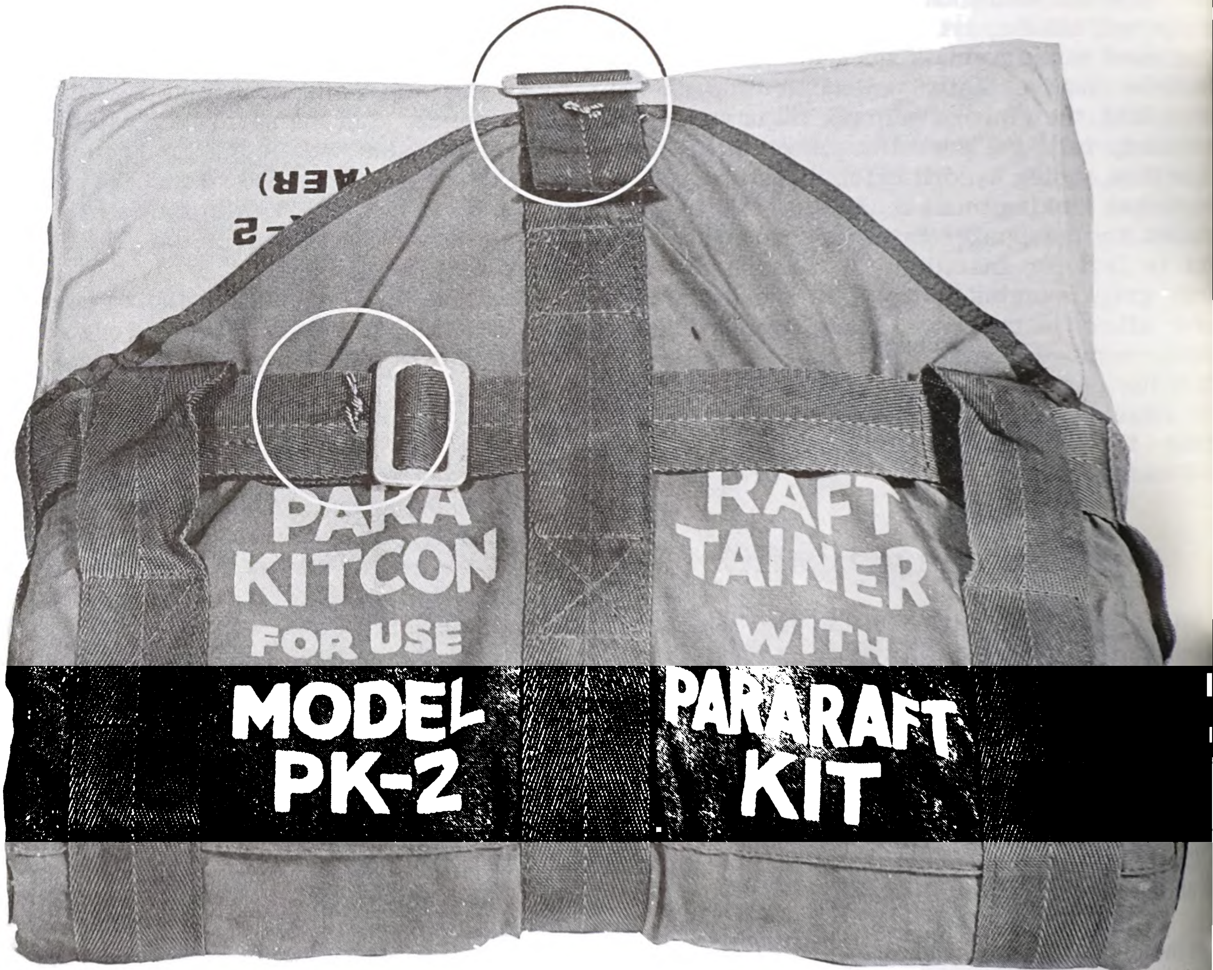


Figure 6-5.—Fitting the pararaft kit container to the pararaft kit.

7. Place a seat cushion over the main sling and pass the leg straps up through the slot provided in the cushion. Tack the cushion to the pararaft kit container using the same tackings and tacking pattern used in tacking the container to the parachute pack. Insert the pararaft kit, fasten the quick-release device, and reposition the lift webs for tacking. Tack the lift webs with a single loop of doubled E nylon thread through both thicknesses of webbing and the container fabric on both sides of the webbing, about one-fourth inch from the edge of the webbing and inside the pack frame as close to the frame as possible. Return the thread outside the wire frame and tie off with a surgeon's knot.

NOTE: The thread must pass through the reinforcement on the underside of the container to prevent tearing the fabric of the contain when the parachute is released.

PACKING THE SEAT TYPE PARACHUTE

Hook up the parachute and make preparatio for packing. When the parachute is properly la out, the nameplate will be uppermost in t center of the top gore, and the canopy will divided into two equal groups of gores with t suspension lines extending from the skirt he to the connector links in four equal groups.

Check the suspension lines for continuity a straighten the vent hem.

NOTE: Straightening of the vent hem is very important step. It must be as nearly strai

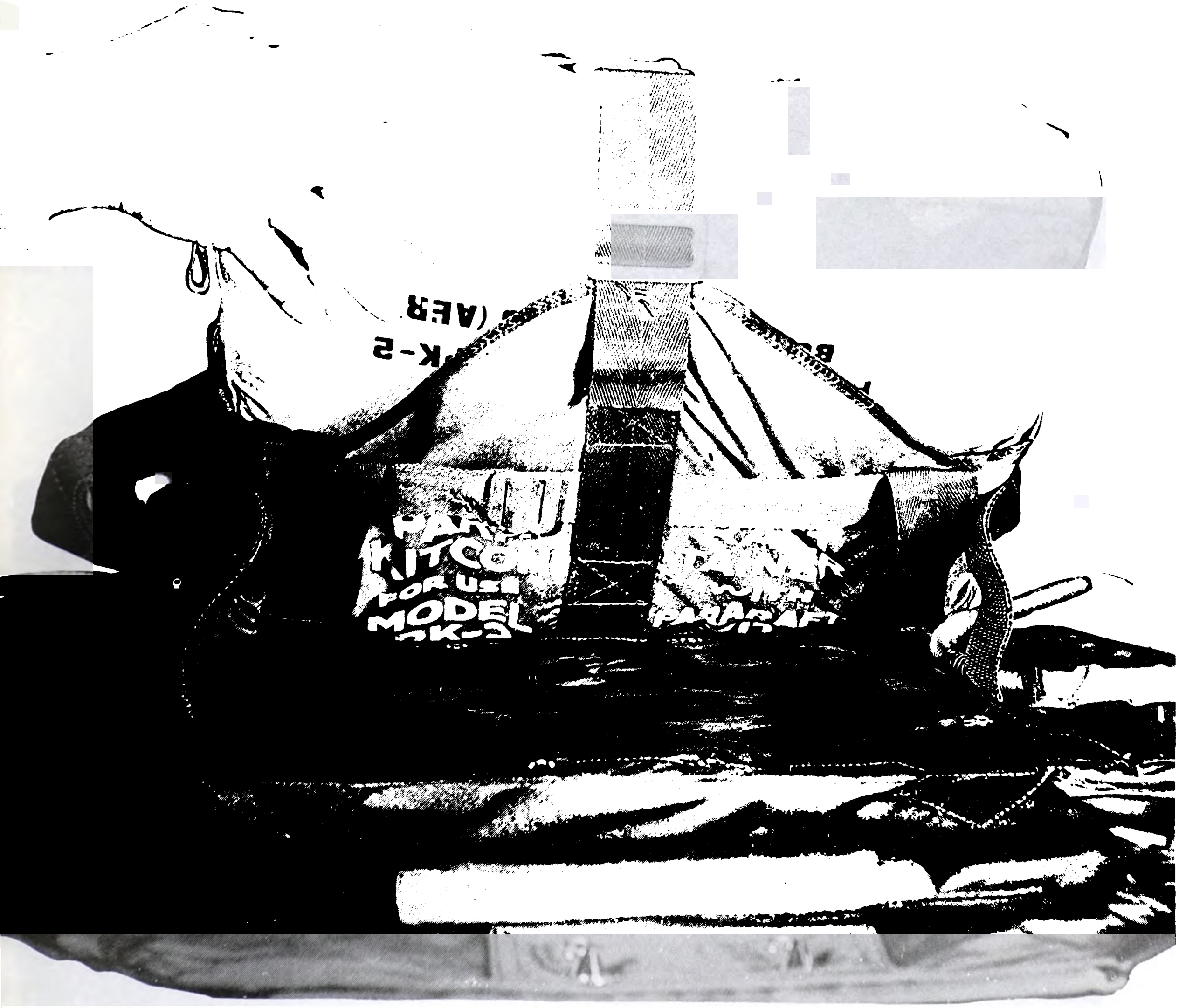


Figure 6-6.—Passage of the pararaft retainer straps through the pack slots before engaging the adapter.

possible in order to make a neat and compact ling of the main canopy at the skirt hem.

Check the nameplate and compare the infor- tion found thereon with that of the Parachute ord Card and the Parachute History Card.

IPPING AND FOLDING THE CANOPY

Whip and fold the canopy in the same manner described in chapter 5 of this course for the st type parachute. Release the tension on the opy and place the pilot chute on top of the main canopy near the apex. Placing the pilot chute on the canopy will prevent it from falling off the table and pulling the main canopy with it.

STOWING MAIN CANOPY

Stow the suspension lines in the same manner as for the chest type parachute. Use caution when stowing to assure that all lines remain straight and without tangles or twists which might cause a malfunction in the opening of the parachute.

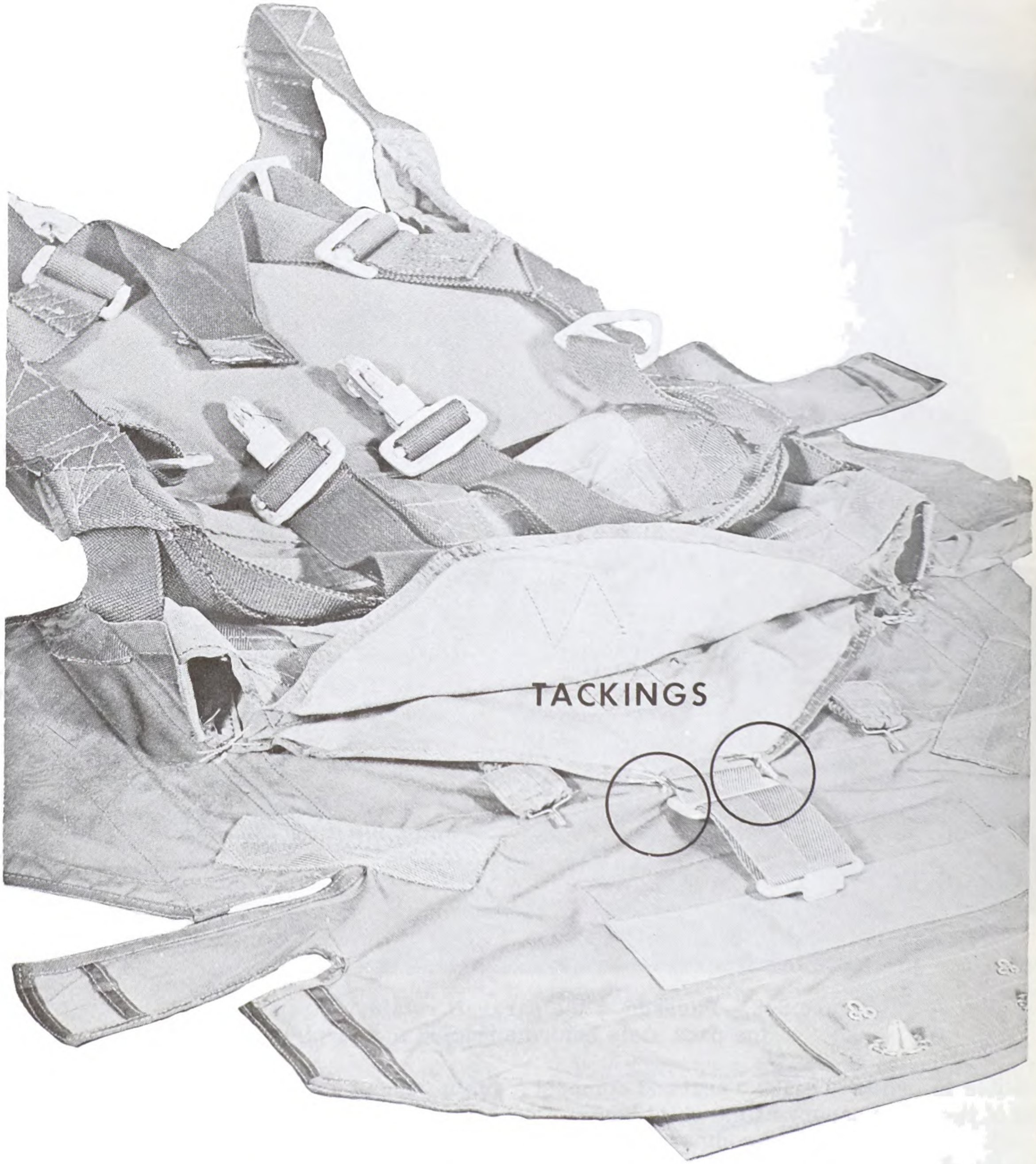


Figure 6-7.—Note that tackings do not pass through webbing.

Accordion fold the canopy into the container in a manner similar to that used in stowing the chest type, except that all the folds are made 3 to 4 inches wider than the pack frame on each side, and the third and fourth folds should extend over the ends for the same 2 to 3 inches. This extra width and length of t folds allow a flatter and more compact fi ished pack.

After completion of the folding, insert t lift web protector flaps between the lift we and the fabric of the canopy.

ERTING THE PILOT CHUTE

The pilot chute is of the coil spring vane . It should be extended vertically above the k when preparing to insert it in the pack to re that no knots or entanglements are in connector cord. Position the pilot chute same as for the chest type parachute. Close pack while maintaining the flat condition forcing the canopy down to the sides. Insert ripcord and smooth out the ends of the pack the long bar. When necessary to straighten end flaps additionally, use the fid in making these adjustments. The fid is also used to straighten or completely insert the lift web protector flaps. When using the fid or the long bar, take care to prevent tearing or ripping the fabric of the container or tearing out the seams of the flap pockets.

Do not permit the canopy to protrude or show at the corners of the pack. Insert the ripcord handgrip into the handgrip pocket and safety-tie the ripcord pins.

Hook the opening bands to the side and end flaps, and recheck the Packing Record Card for proper signature.

CHAPTER 7

PACKING AND RIGGING THE BACK TYPE PARACHUTES

The Navy back type (NB) parachute is specially designed for use in high-speed aircraft. It is positive and stable, and the pack is thin and comfortable to the wearer. The many configurations of this parachute make it a very useful item of survival equipment.

Parachutes of this general design are the NB-6, NB-7, NB-7E, NB-8 and NB-9. Another back type, but of a different design, is the Martin-Baker. This type is used with the Martin-Baker ejection system and is discussed in chapter 8.

The NB-6 and NB-8 are used with the standard harness, while the NB-7 and NB-9 are used with the integrated harness. The integrated harness combines the lap belt and parachute harness into an integrated assembly and forms a part of an ejection system. By installing an automatic parachute actuator, any of the back type parachutes may be used with an ejection seat.

To avoid repetition, and yet cover the rigging and packing procedures for the maximum number of back type parachutes (both with and without the integrated harness), this chapter deals only with the NB-6, NB-8, and NB-9 parachutes. Chapter 8 deals entirely with the Martin-Baker parachute assembly.

RIGGING AND PACKING WITH STANDARD HARNESS

Since the Parachute Rigger School is a prerequisite for advancement to PR3, step-by-step procedures for packing the NB-6 and NB-8 are not listed. The airman working in the parachute loft and striking for PR3 should refer to NA 13-5-501 (Parachute Manual) frequently and become thoroughly familiar with the packing procedures listed. Be sure to check applicable Aviation Clothing and Survival Equipment Bulletins for changes and modifications to the equipment being serviced, BEFORE doing any maintenance work.

RIGGING WITHOUT PARARAFT

Clean packing table and lay out tools as y would for other standard Navy parachutes. I spect carefully, and make necessary repairs the parachute and its components BEFORE b ginning the packing procedure.

Attach the container to the harness. Tack t ripcord housing to the pack and the grip pock (Do not secure the pocket to the harness with t and bottom tackings until after the packing completed.) Secure the pararaft retaini straps. A back type cushion, developed for un versal use on service type parachutes, is i stalled on the body side of the harness in a ma ner similar to the installation on the seat ty (ch. 6), except that the lift web keepers are used, but are snapped in place to avoid entang ment.

Inspect (in accordance with procedures ou lined in ch. 10) and install a Master Specialti 1000D actuator in the pocket provided on t pack. Route the arming cable out through t buttonhole in the side of the pack and the pow cable out through the end of the pack parallel the left riser. Close and snap cover flap.

After thoroughly inspecting the canopy, su pension lines, pack, harness, and other comp nent parts, the chute is hooked up and placed und tension with the harness in the position of a m lying face down with his head toward the canop

Whipping and folding the canopy is done the same manner as for the NC-3, except th the folded width conforms to the width of t NB-6 or NB-8 container.

Release tension and tack the risers over t fifth metal stiffener from the bottom of the pa with one turn of 3-cord nylon or two turns of nylon thread. Sign the Parachute Record Ca and make a corresponding entry on the Parach History Card. Most parachute lofts maintain packing logbook for recording daily output. the event that one is maintained in your loft,

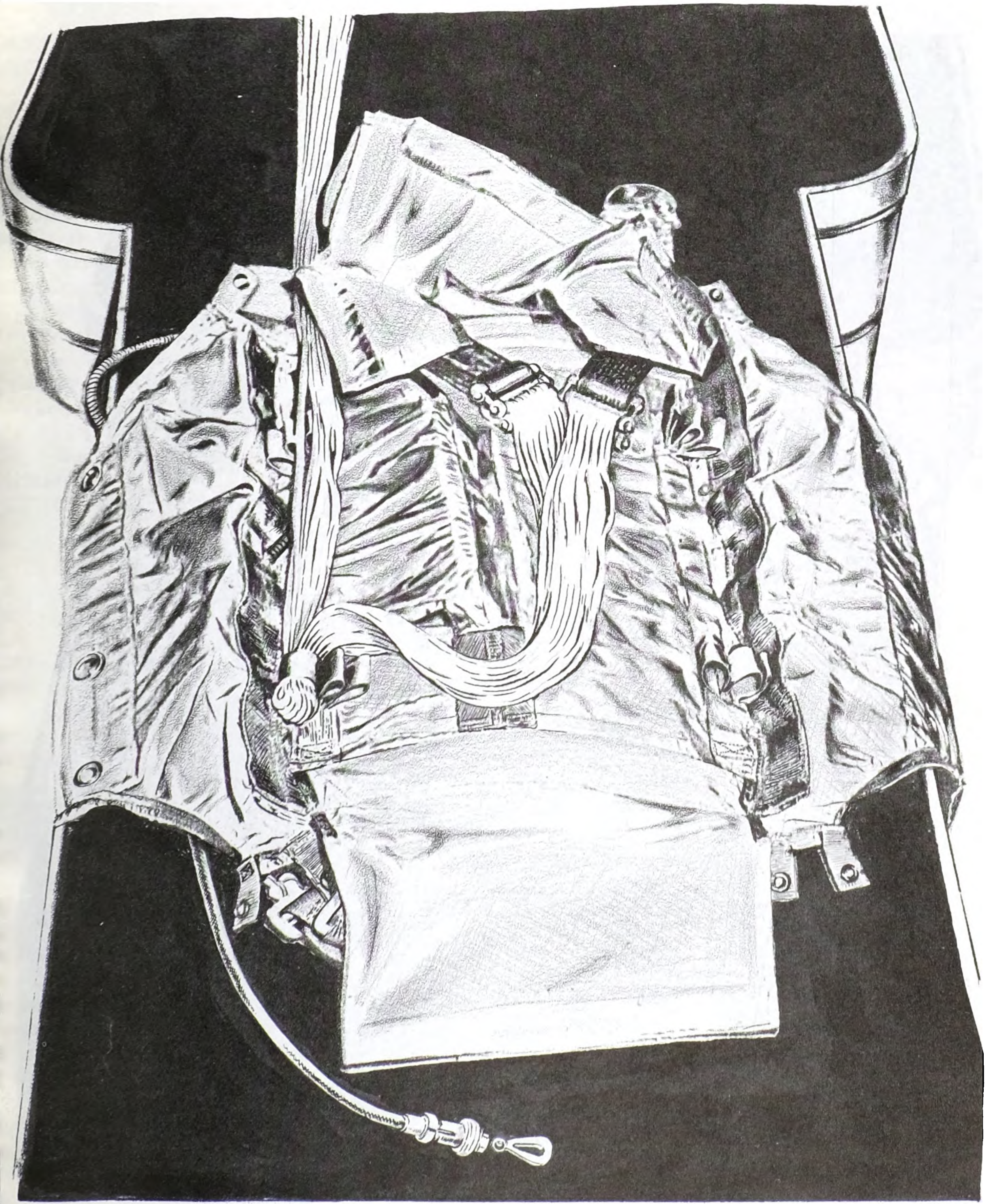


Figure 7-1.—First bight taken in stowing suspension lines. Note that the connector links are positioned over the fifth **stiffener of the pack.**

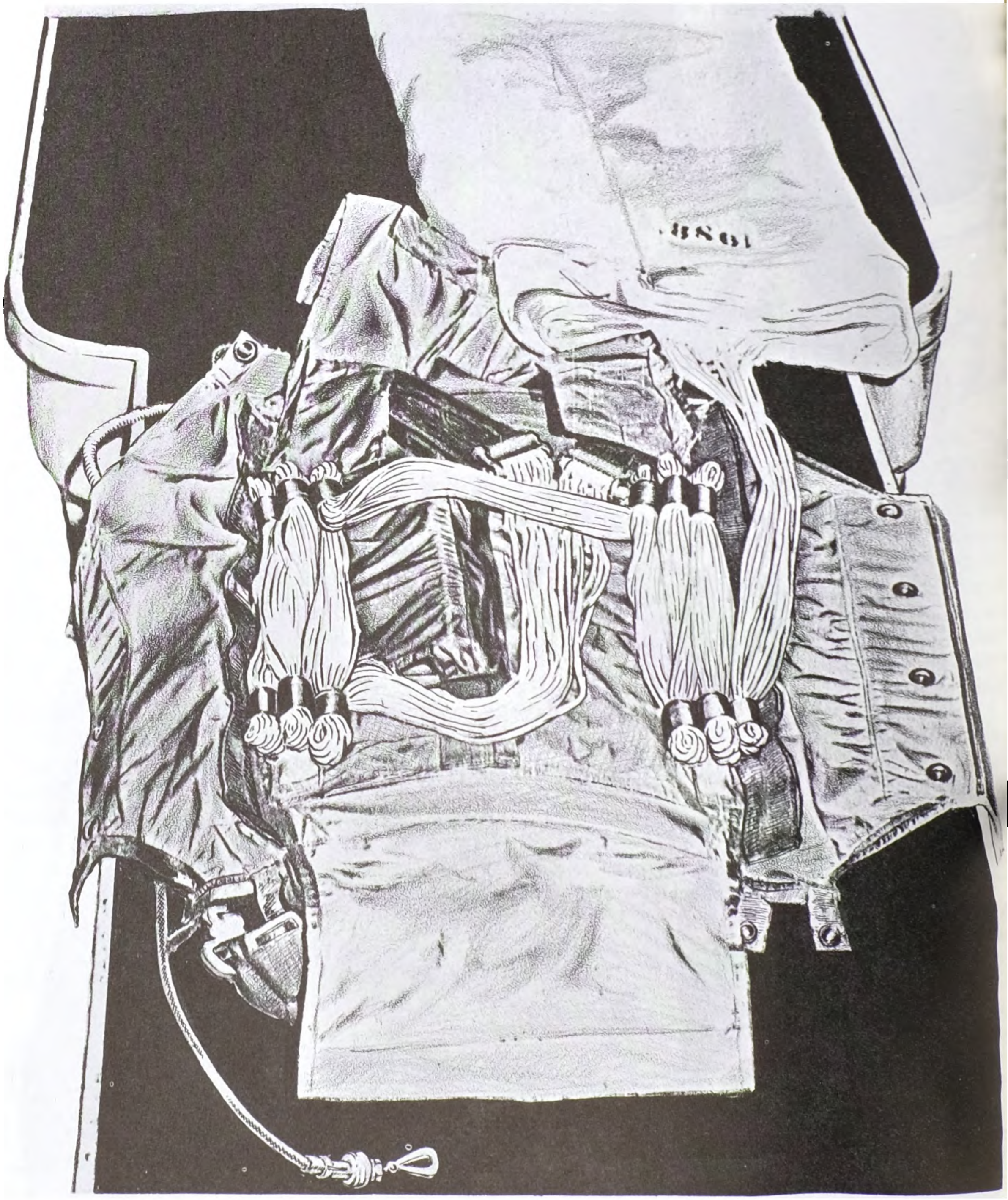


Figure 7-2.—Proper stowage of suspension lines.

y should be made at the same time that the
chute Record Card is signed.

KING THE STANDARD BACK TYPE
ACHUTE

he suspension lines are stowed as shown in
es 7-1 and 7-2. Use extreme care, making
that the suspension lines are stowed uni-
ly and without twists or dropped lines. Care-
ness in this step could mean a loop or twist
e lines resulting in a knot which could pre-
the proper opening of the parachute.

he canopy is folded on the container and the
chute positioned on top. While the pilot
e is held compressed and in place, the side
s are brought up and fastened by inserting
porary locking pins. Straighten canopy fab-
bring up end flaps, and insert ripcord. After
ty-tying the ripcord and fastening the opening
ls, the ripcord handle pocket should be
tioned.

NOTE: The ripcord handle pocket must be positioned and tacked AFTER the parachute is completely packed and adjustments have been made. An improperly positioned pocket will cause premature opening of the pack and could result in severe damage to the parachute.

Recheck the Parachute Record Card for proper signature and insert in the packing data card pocket.

RIGGING WITH PARARAFT

Rigging the back type parachute with a pararaft kit is a simple procedure in comparison with the same task on the seat type parachute. There is no ripcord replacement problem here, and the changeover can be accomplished while the parachute remains in a packed condition. Fit the pararaft kit case to the pararaft kit container in the same manner as for the chest and seat type parachutes. Secure the adjustments with tackings. Release the pararaft retaining straps and proceed in accordance with the steps shown in figures 7-3 through 7-7.

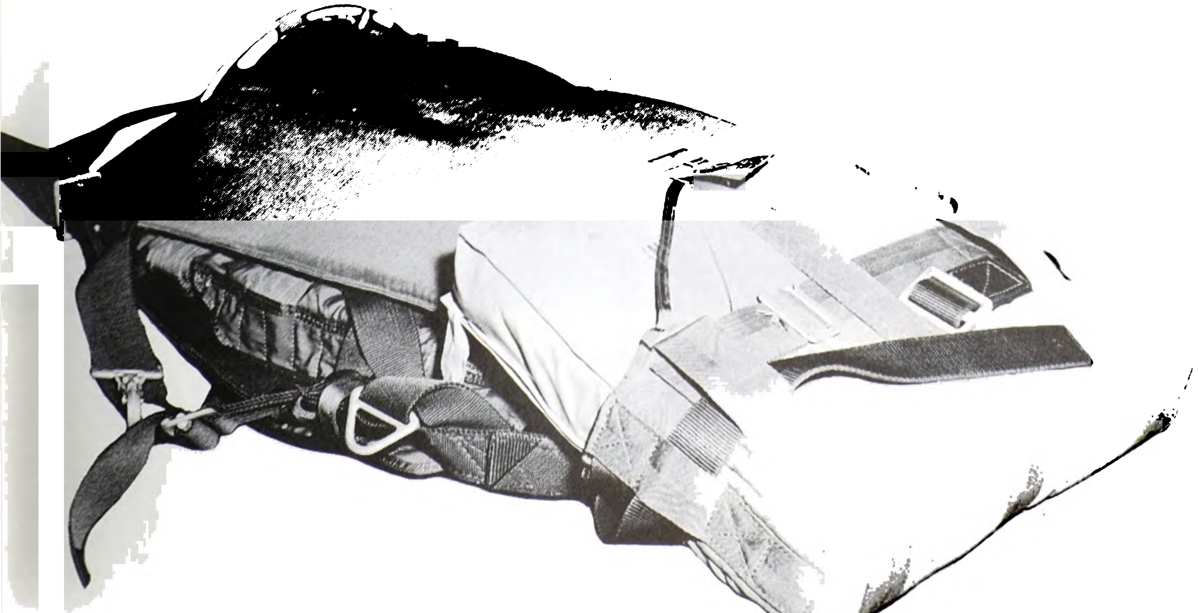


Figure 7-3.—Retaining straps passed through side and bottom keepers. Pass retaining straps through side and bottom keepers of the case with the PK-2 pararaft kit fitted into the kit case.

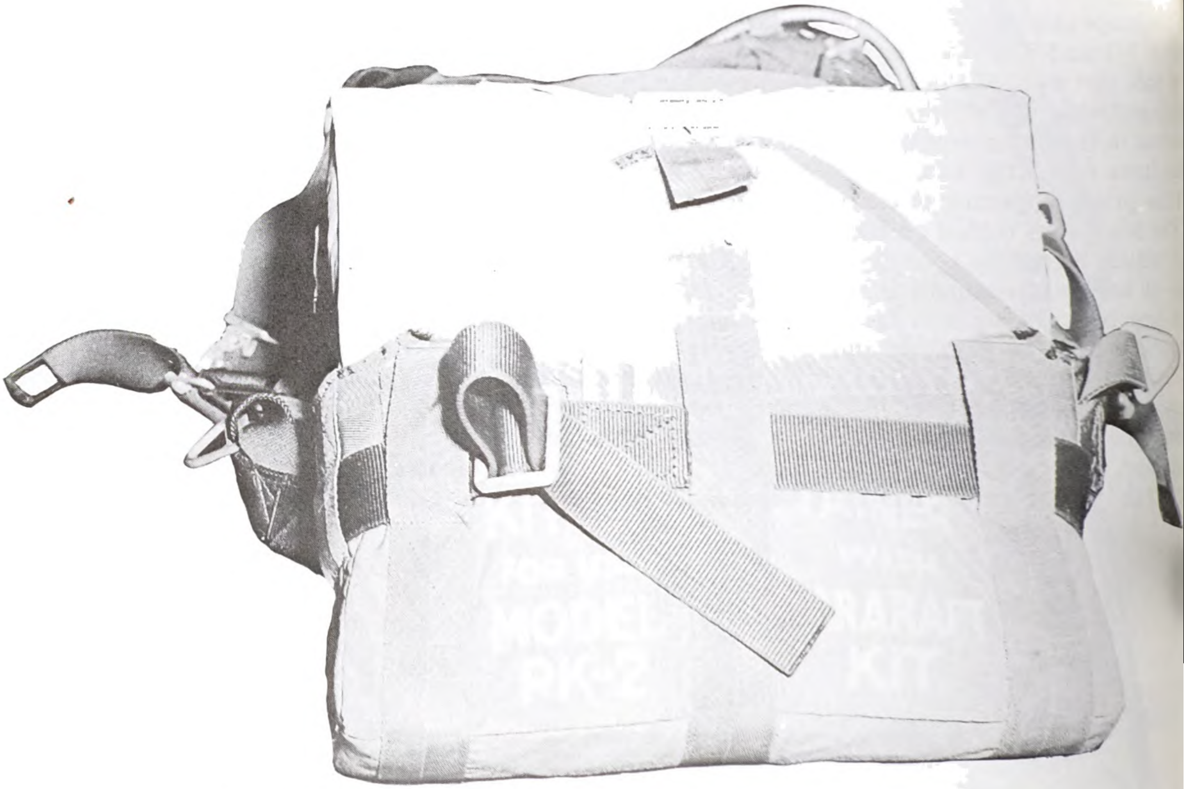


Figure 7-4.—Adapter retaining straps drawn through keepers. Pass the adapter retaining strap through center keeper and the opposite retaining strap through adapter in preparation for drawing the main sling of the parachute harness and the para-raft kit container together.

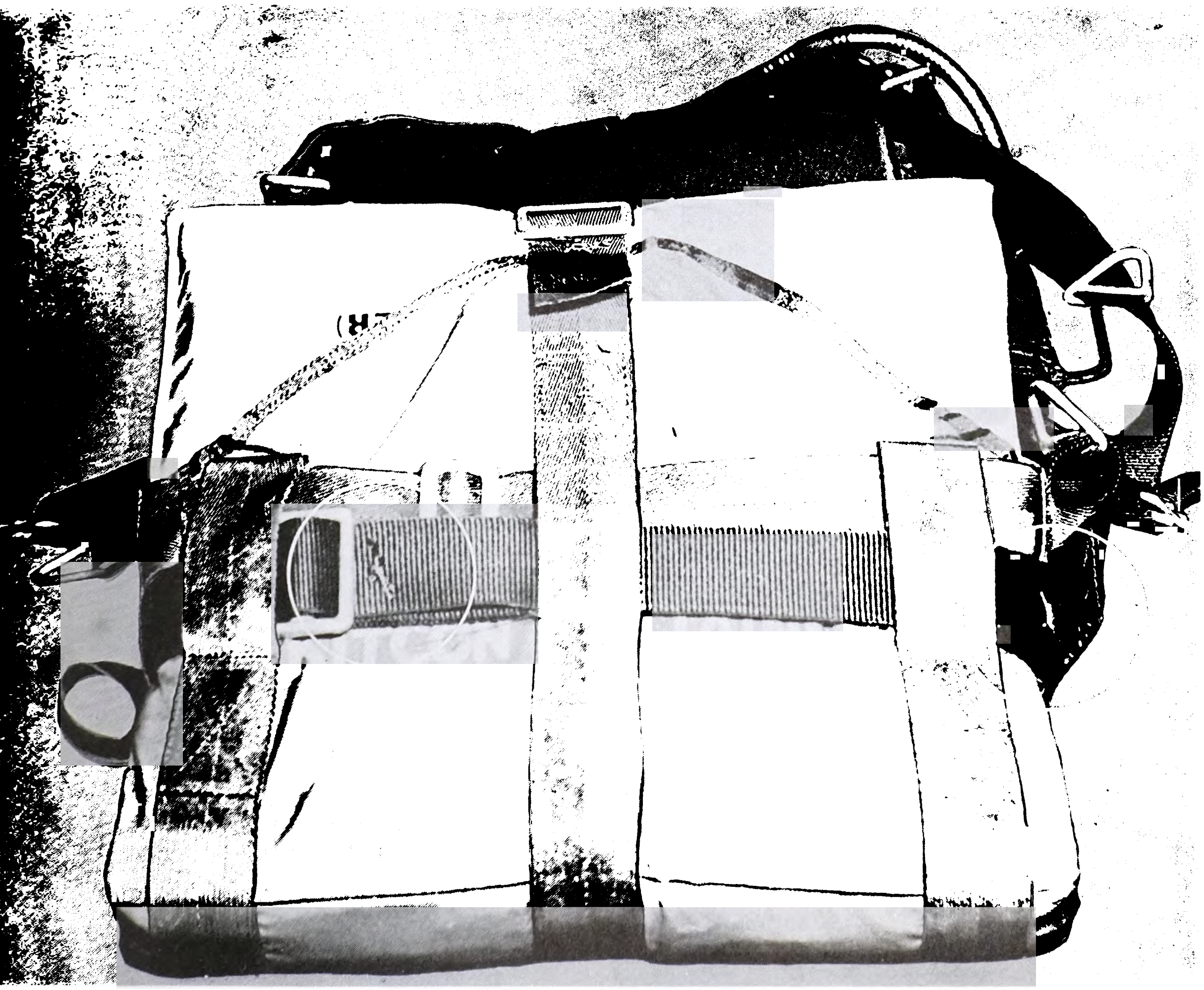


Figure 7-5.—Adjustments and tackings to the retaining straps. Adjust free end of retaining strap and tack to harness, then make a second tacking close to the adapter and on the free side to hold the adjustment in place.

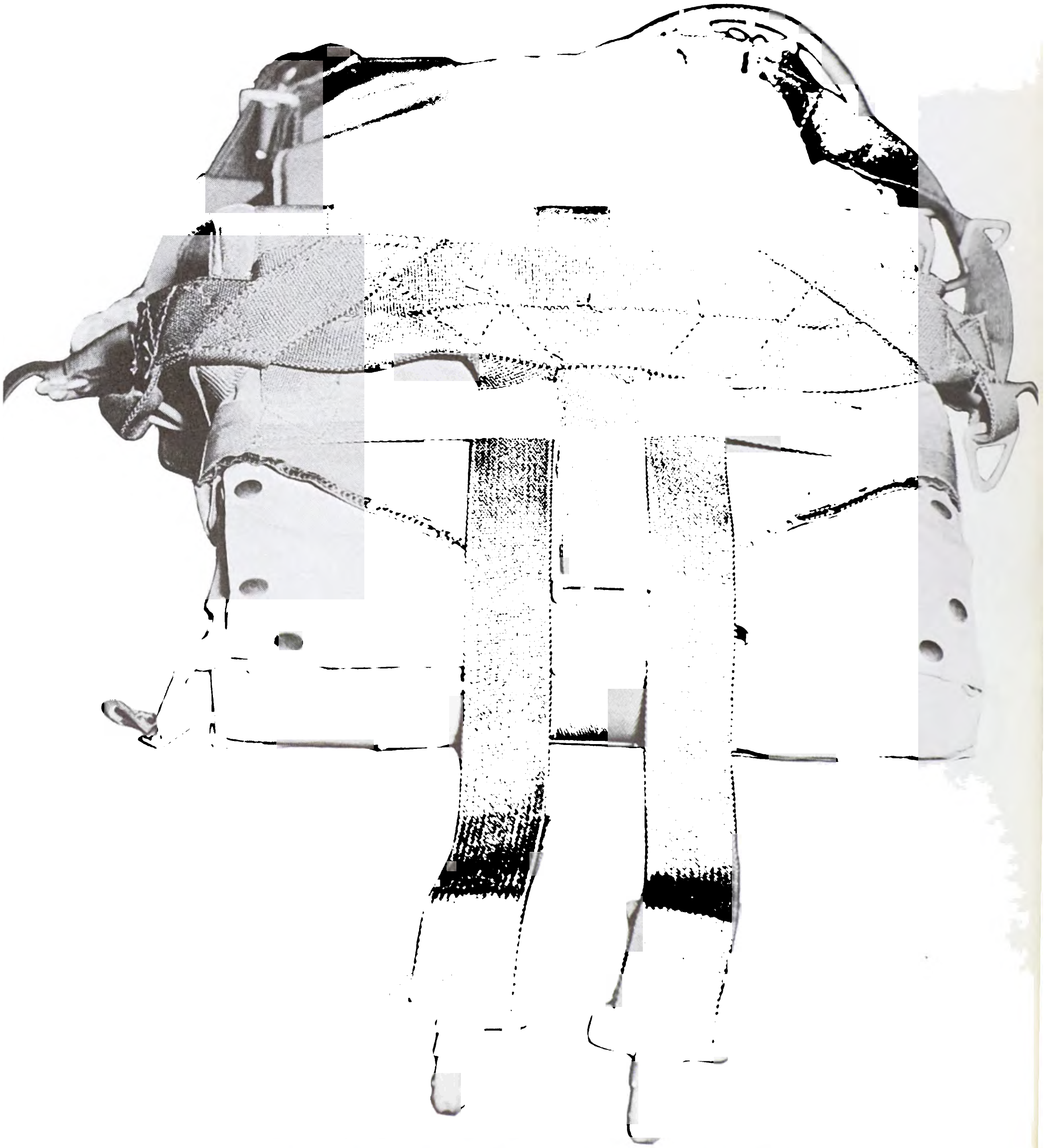


Figure 7-6.—Leg straps passed through keepers. Pass the leg straps through the keepers on the kit container, making sure that the straps come through the keepers toward the front of the container.

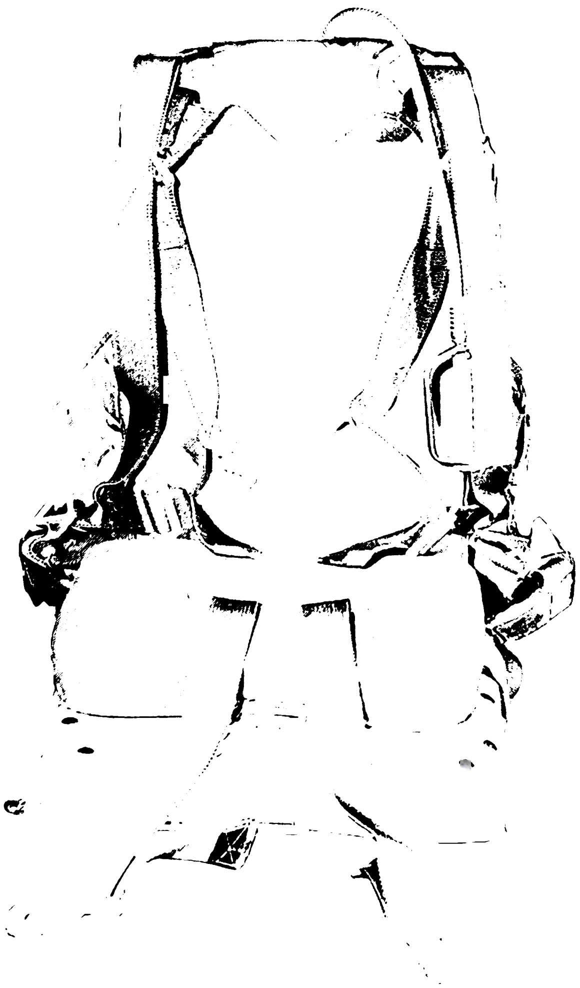


Figure 7-7.—Seat cushion tacked in place. Tack seat cushion to kit container in same manner as applied to the seat type parachute cushion.

PACKING WITH INTEGRATED HARNESS

The NB-9 parachute is an integrated back type parachute assembly designed for use with the Rocket Assisted Personnel Ejection Catapult (RAPEC) escape system. It consists of a semi-rigid contoured pack, a 28-foot flat circular canopy, PA-7 pilot chute, integrated riser, shoulder, and lap belt assembly used with a seat pan and a PK-2 pararaft kit in a high-speed container.

The NB-9 assembly is designed to be equipped with a Master Specialties 1000D barometrically controlled automatic parachute actuator, incorporating a BuWeps Mk V Mod 0, 2-second delay cartridge.

The contoured pack of this assembly provides improved comfort and compatibility with the aircraft cockpit. Conventional type closing flaps, attached to a Fiberglas frame, together with an integral comfort pad, comprise the basic portion of the pack. The semiclosed corners of the pack provide improved windblast integrity. Improved comfort, as well as appearance, is achieved by routing the pack opening bands through webbing tunnels on the inside of the pack and eliminating external snaps, buttons, etc., on the forward surface of the pack.

To assure optimum compatibility of the NB-9 parachute and rocket assisted ejection seat, it is essential that the parachute be packed as flat as possible. A relatively flat pack is necessary to maintain adequate knee clearance during ejection, provide good back support during catapult launching and minimize rocking of the parachute against the seat back.

The NB-9 incorporates the PA-7 vane type pilot chute which has eight vanes and a substantially stronger helical spring than the PA-8. It is attached to the canopy with a bridle that measures 36 inches (± 1/2) from the suspension lines at the vent of the 28-foot canopy to the pi chute tie-off loop.

PROCEDURE FOR PACKING THE NB-9 PARACHUTE

Packing the NB-9 is similar to the packi of other back type parachutes in that it is whipp and folded and the suspension lines are stow in the same manner. Therefore, only the var ations in packing are discussed in this chapte Various packing steps are illustrated in figur 7-8 through 7-28.

A manual ripcord release device must installed on all NB-7, NB-7E, and NB-9 par chutes as directed by ACSEB 14-62. The clar assembly may be obtained in kit form, but guide and lanyard assembly are to be made locally.

The guide assembly is fabricated from a 1 inch length of type VI nylon webbing. Fold webbing at the center and stitch around all edge leaving a 1/8-inch margin. Sear cut ends. Insta a grommet, MS20230B4, in one end and atta the other end to the container with at least handstitches of a double strand of size E nyl thread. Attach at a point adjacent to and parall with the connector link on the bottom left-ha riser. (See fig. 7-12.)

The clamp release device retains the manu ripcord and power cable housing to the contain (fig. 7-13). The release of the ripcord housing effected by the risers being pulled from the co tainer by the pull of the suspension lines fr the main canopy. As the risers leave the co tainer, a lanyard attached to the bottom link the left-hand riser (when snapped in the co tainer, fig. 7-12) applies tension to break safety tie and extract the locking pin from stud at the left-hand side of the clamp, releasi the manual ripcord and power cable housi

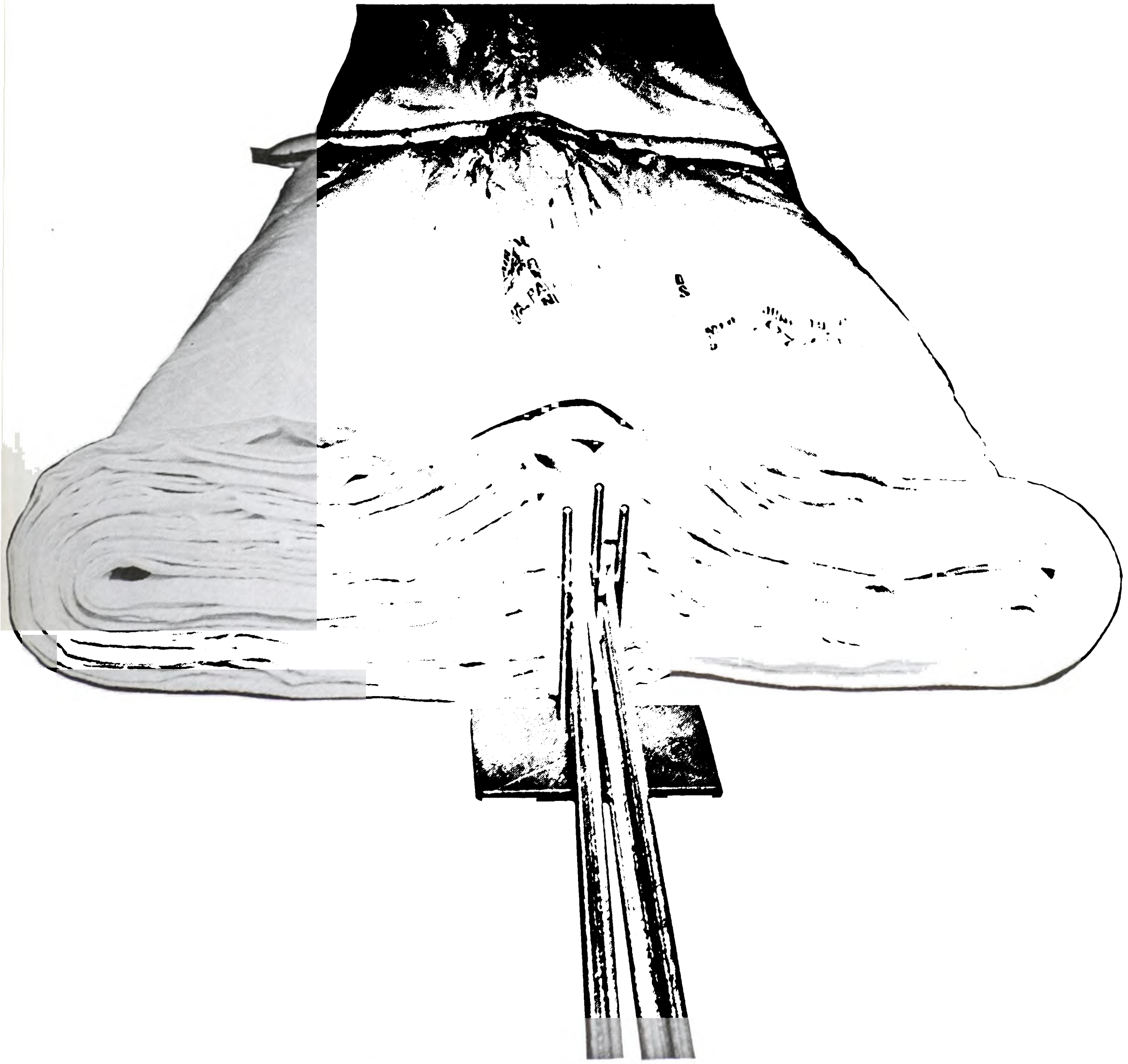


Figure 7-8.—Skirt edges folded to meet at the center of the two top gores. Lay out canopy in conventional manner with the retaining groove in the connector fitting face down on the table. The parachute canopy is then pleated and folded so that the skirt edges are folded to meet in the center of the two top gores.

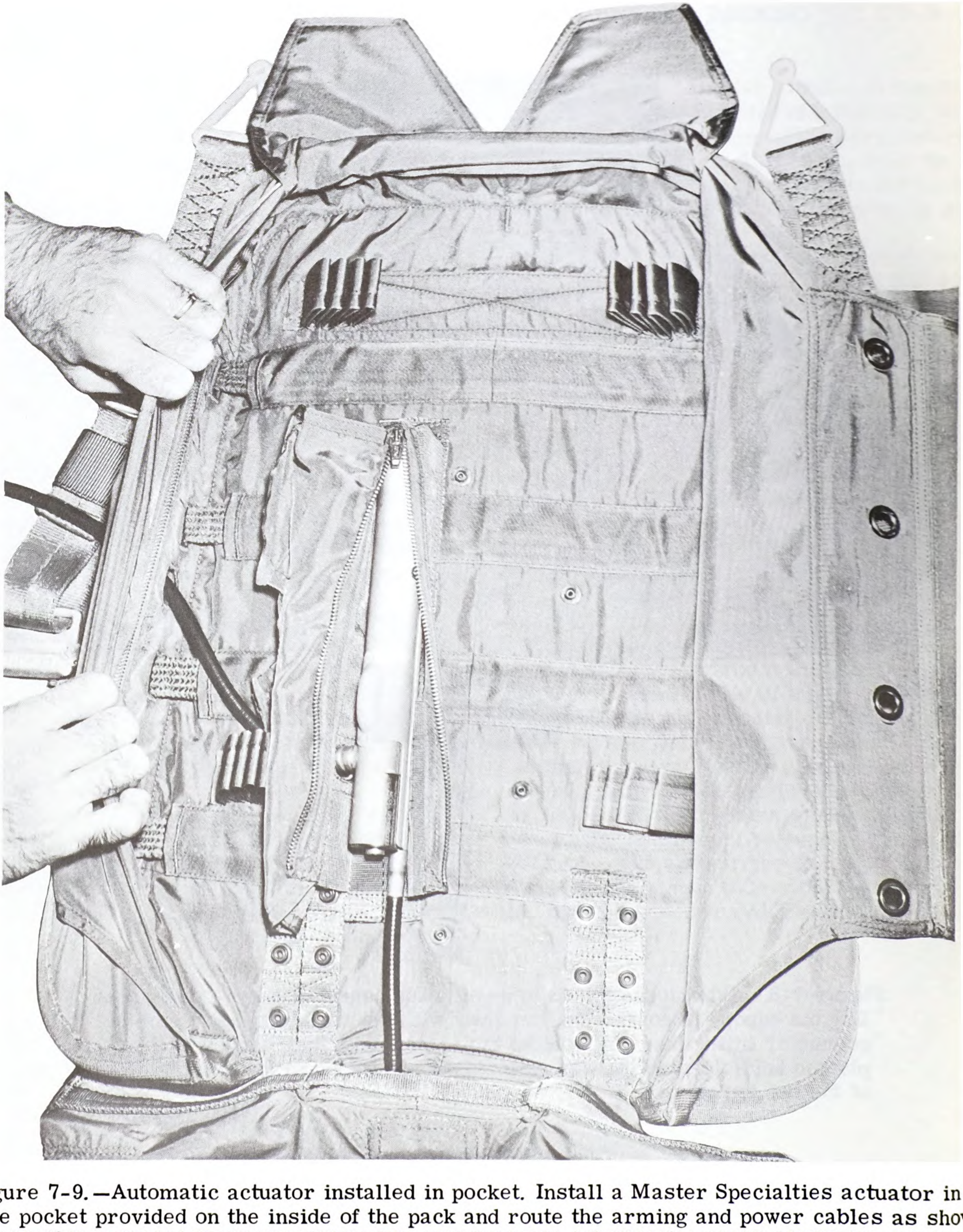


Figure 7-9.—Automatic actuator installed in pocket. Install a Master Specialties actuator in the pocket provided on the inside of the pack and route the arming and power cables as shown. CAUTION: THE MASTER SPECIALTIES AUTOMATIC ACTUATOR 1000D MUST BE LOADED WITH A MK V MOD 0, 2-SECOND DELAY CARTRIDGE (COLOR CODE BLUE).

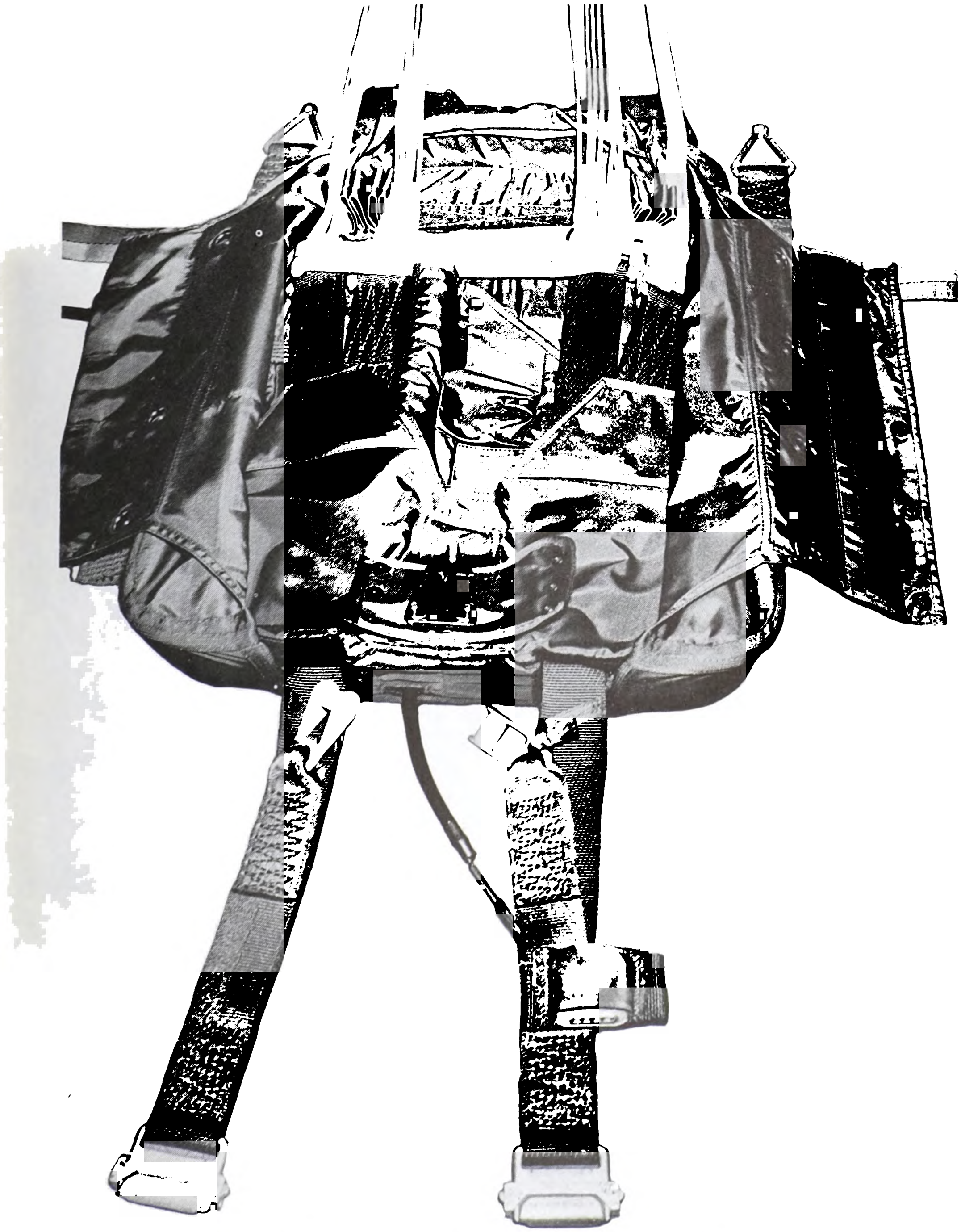


Figure 7-10.—Container positioned under risers. Slide container under the risers with the top of the pack nearest the riser connections.

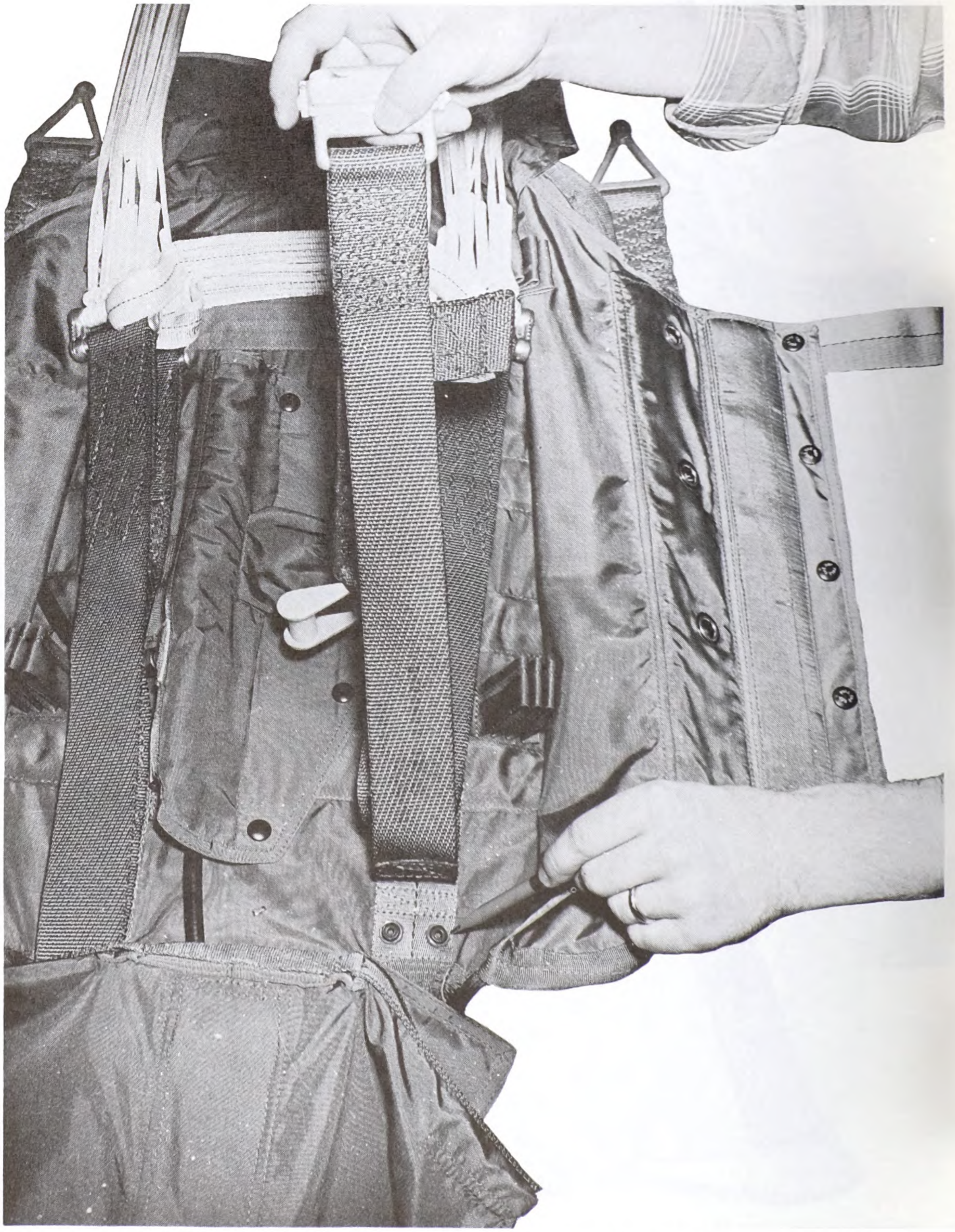


Figure 7-11.—Risers snapped to bottom set of pull-the-dot studs.

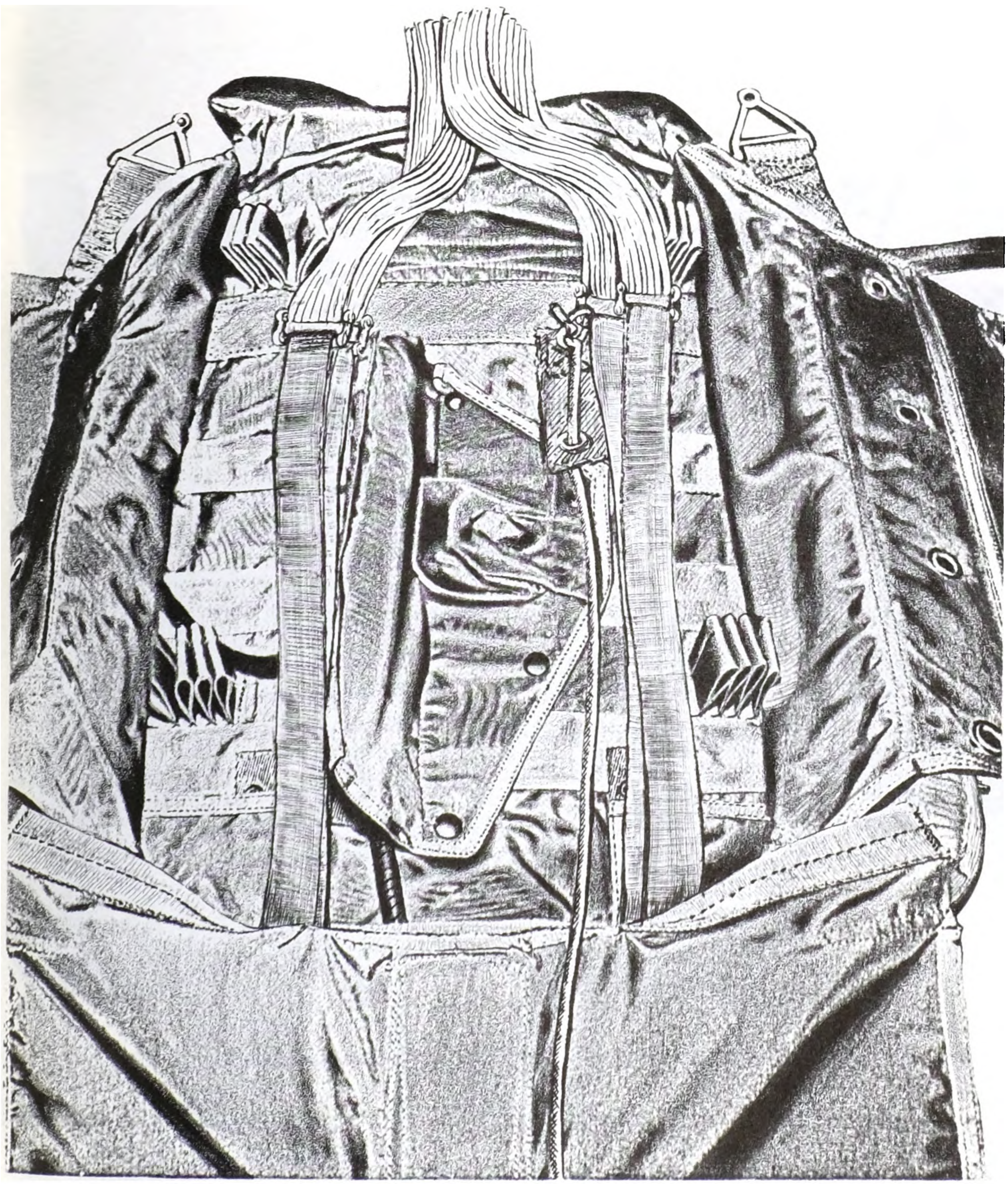


Figure 7-12.—Attachment and routing of ripcord release clamp lanyard. Fabricate lanyard assembly from a 43-inch length of type III nylon suspension line in accordance with ACSEB 14-62 and attach as shown.

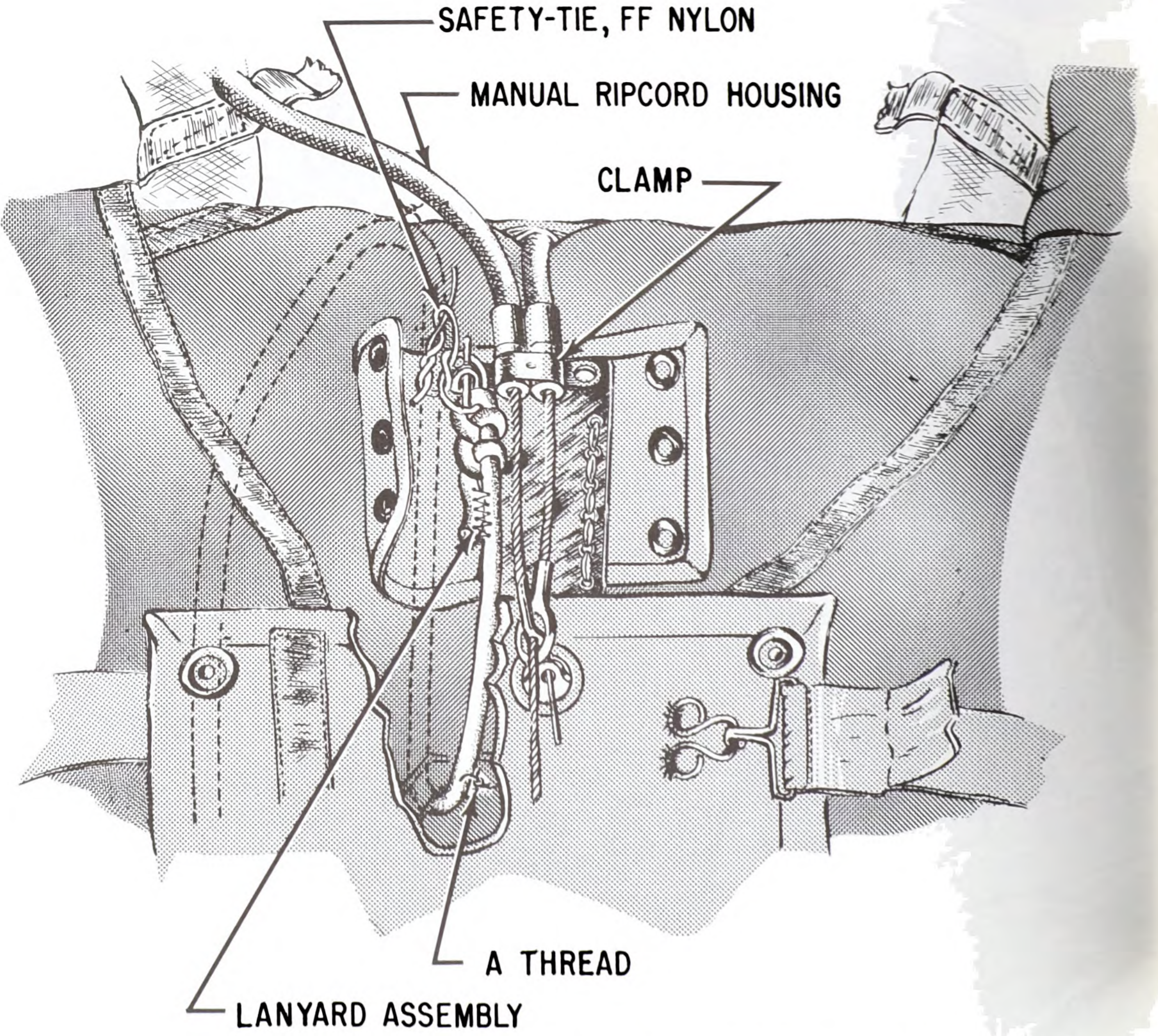


Figure 7-13.—Installation of manual ripcord housing release clamp.

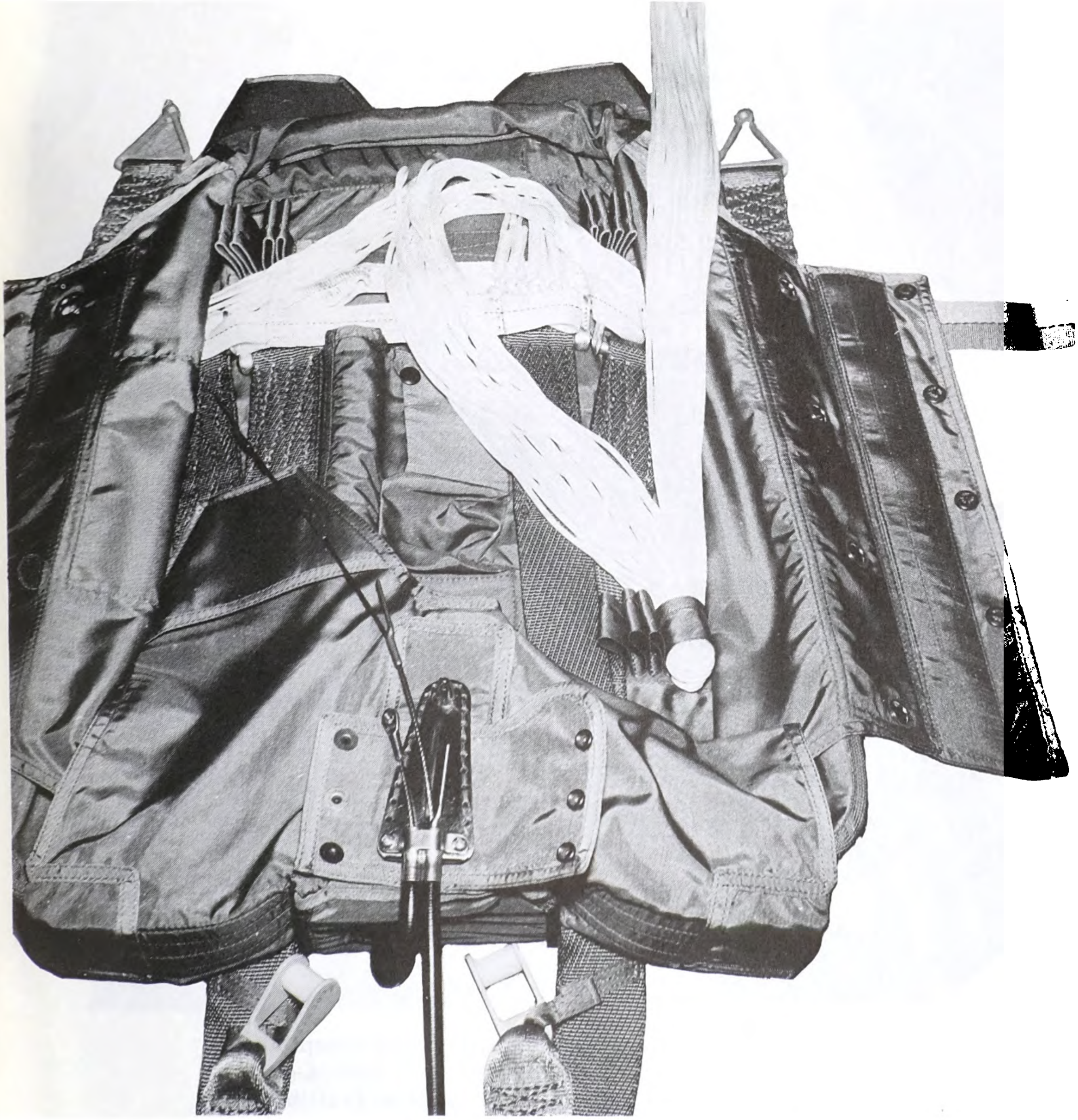


Figure 7-14.—First bight stowed through left-hand retainer loop. Arrange suspension line links and cross connector straps to lie as flat as possible on pack false bottom. Draw the first bight of the suspension lines through top left-hand retainer loop.

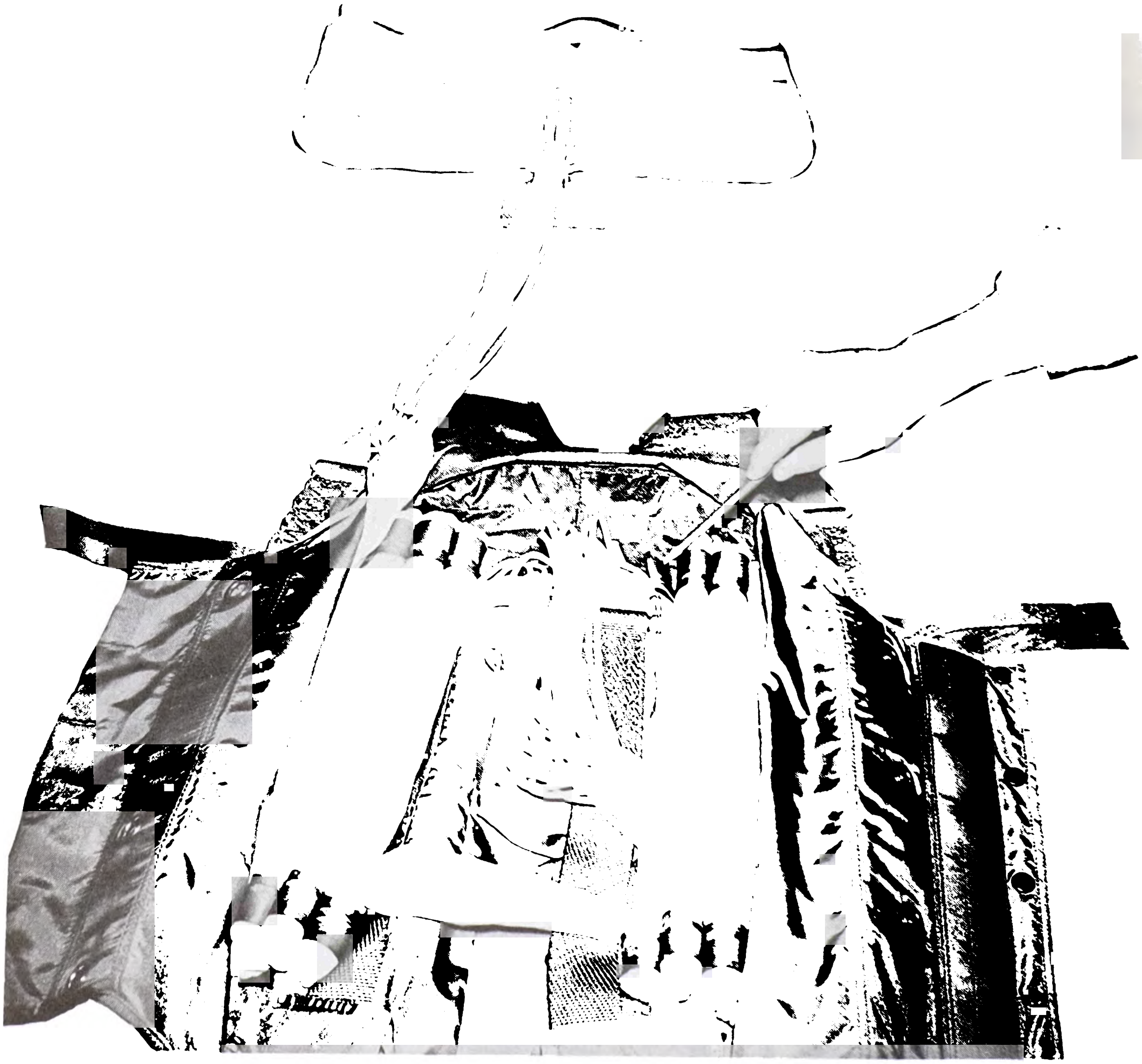


Figure 7-15.—Stowage of suspension lines completed. Stow lines with approximately one-half inch of each bight extending through retainer loops to facilitate proper extraction. Do not stow lines in bottom inboard loop on the left-hand side.

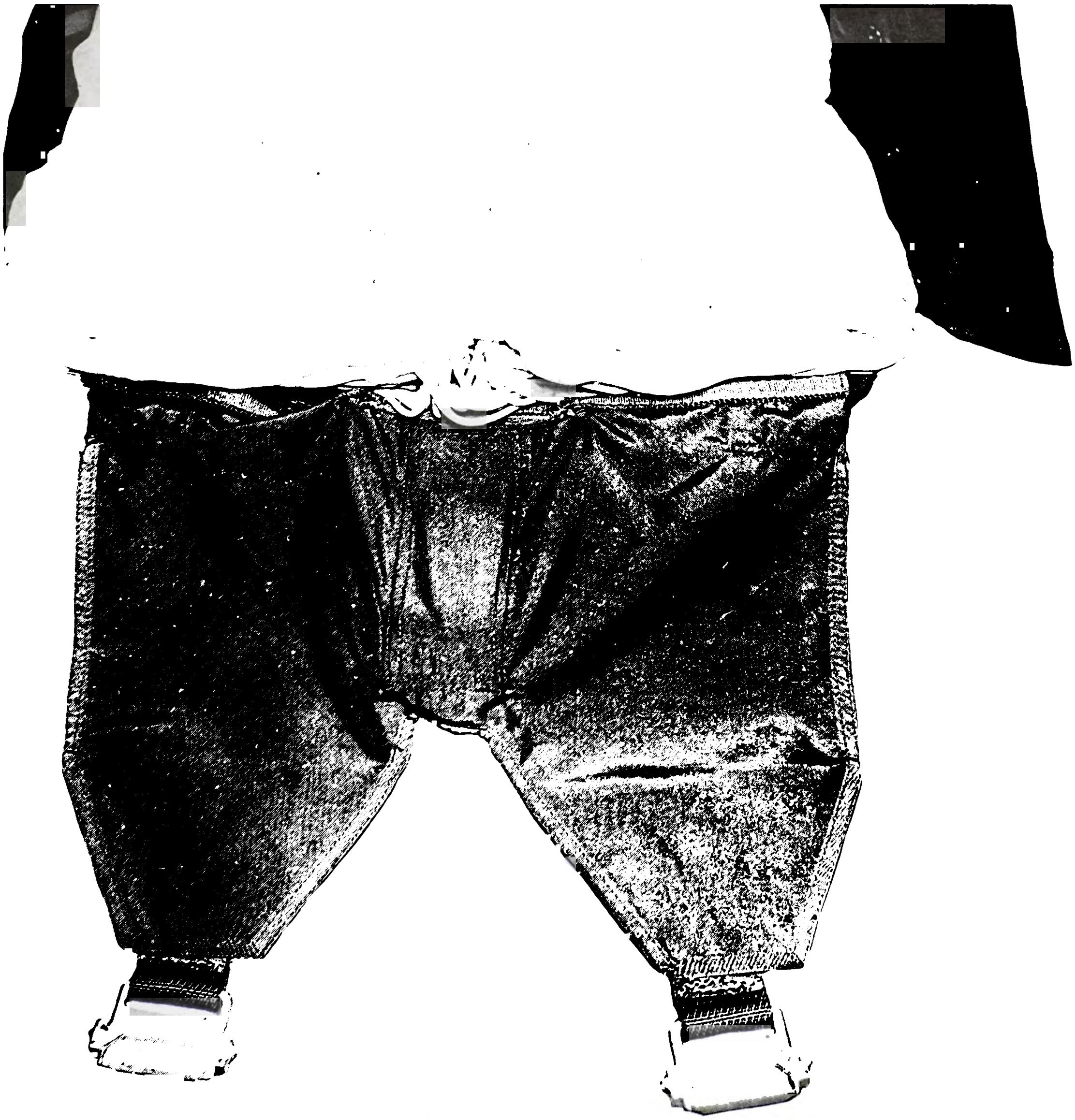


Figure 7-16.—Skirt placed on top of container. Place skirt at top of pack making certain that canopy material is spread beyond outer edges of container.

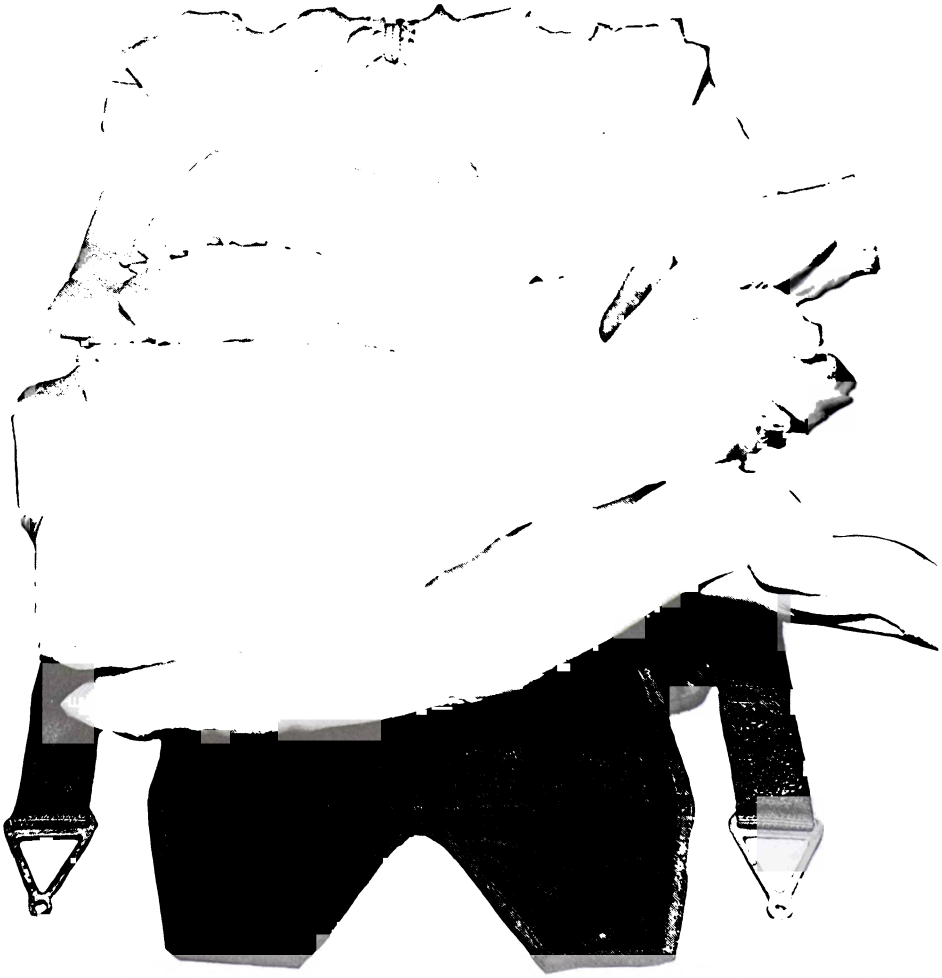


Figure 7-17.—Folding canopy of NB-9. Insert skirt into top portion of container, butting lines against center section of frame and spreading edges into corners. Complete accordion folding of canopy in accordance with standard practice except that only two folds are brought to the bottom of the pack.

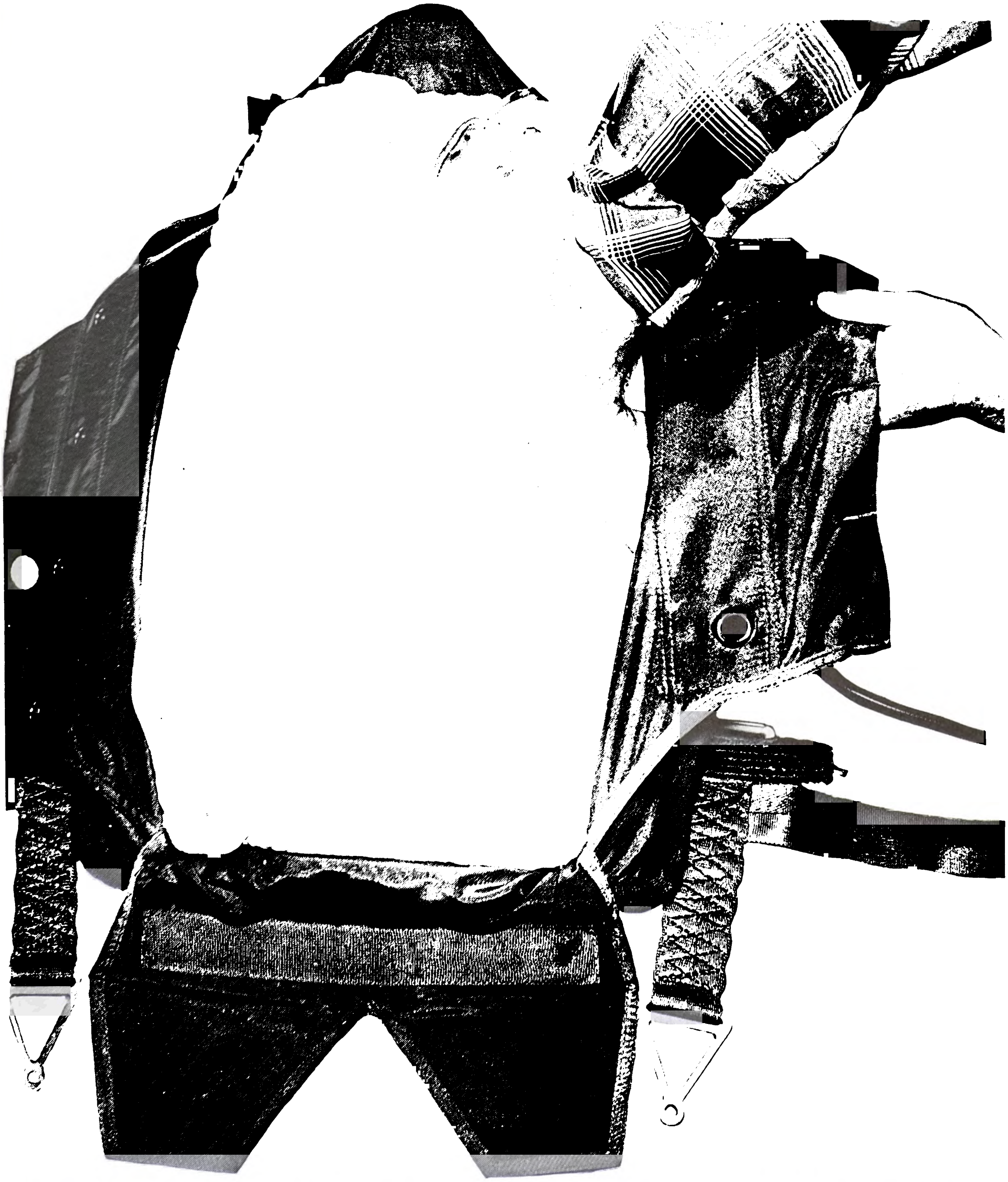


Figure 7-18.—Filling void on outboard sides of container. Fold canopy into container, spreading material to corners and forcing as much as possible into the void between outboard lay of suspension lines and edge of pack. Special attention should be given to filling out top corners solidly. A pack not properly flattened will tend to rock in the seat.

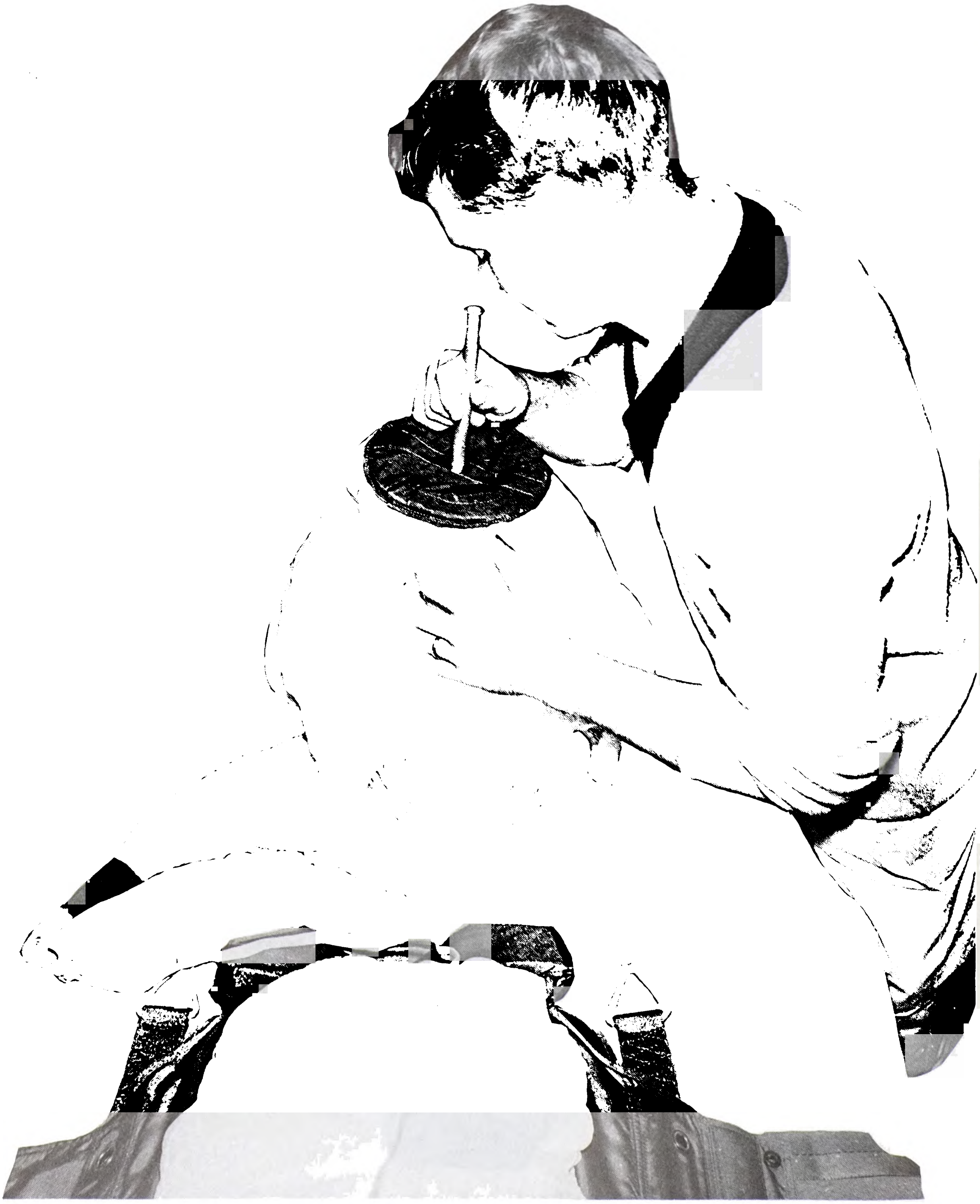


Figure 7-19.—Using guide tube to align cone with grommet. Insert guide tube into grommet in top of pilot chute. Compress pilot chute and align cone with grommet. Insert temporary locking pin and plate in bottom hole of cone; pull nylon material away from cone until none shows through grommet.

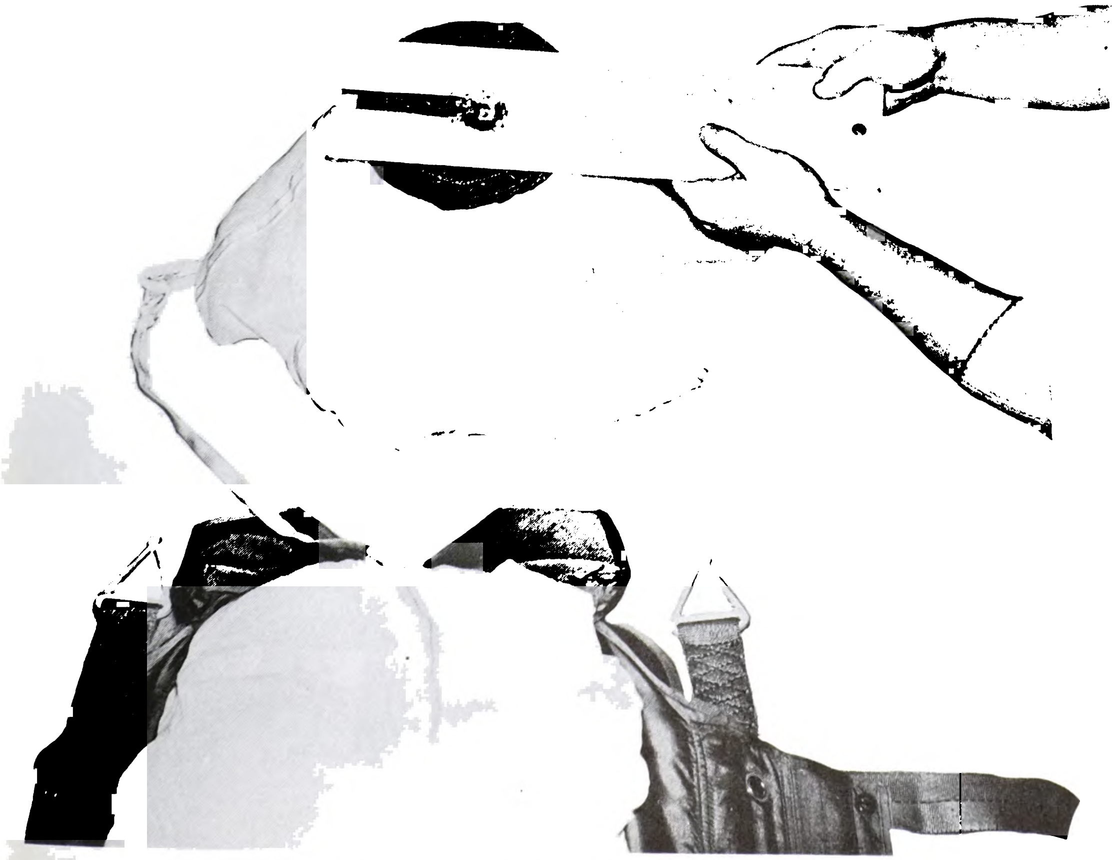


Figure 7-20.—Insert temporary locking pin and place pilot chute on top of folded canopy.

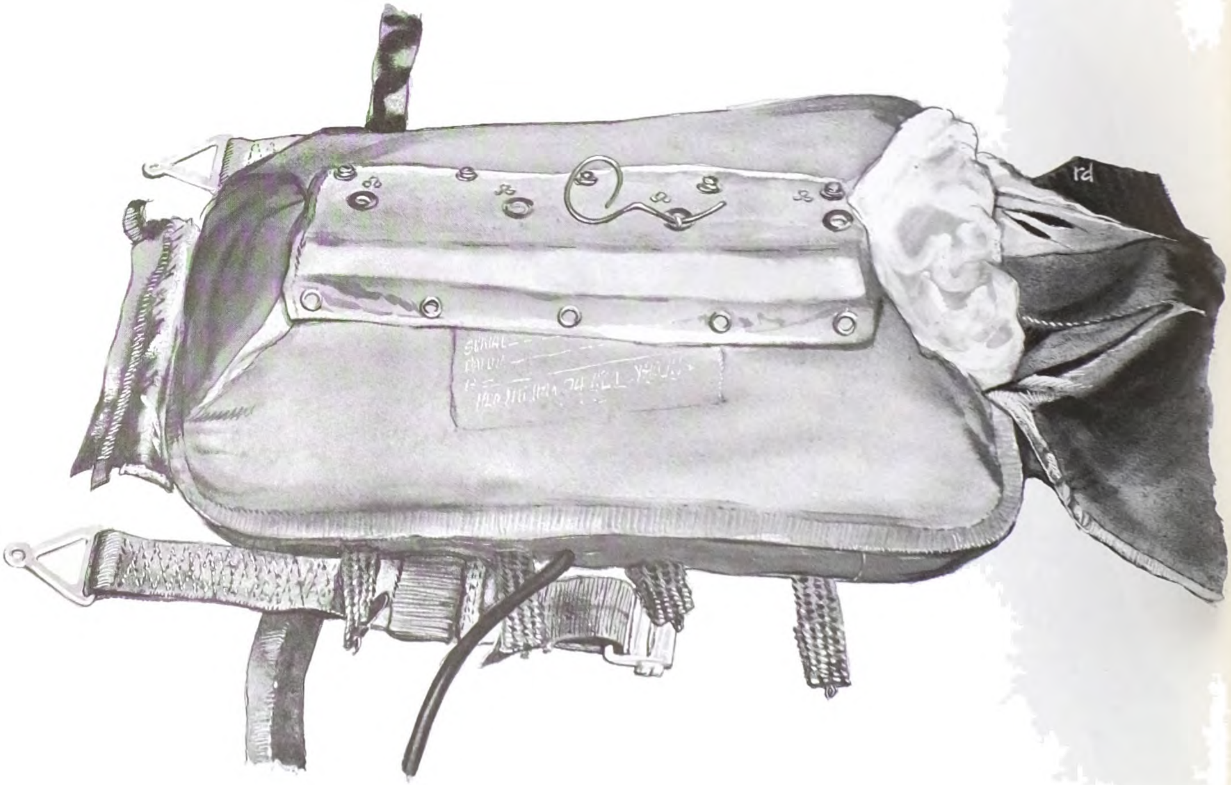


Figure 7-21.—Side flaps pulled up and secured with temporary locking pin.

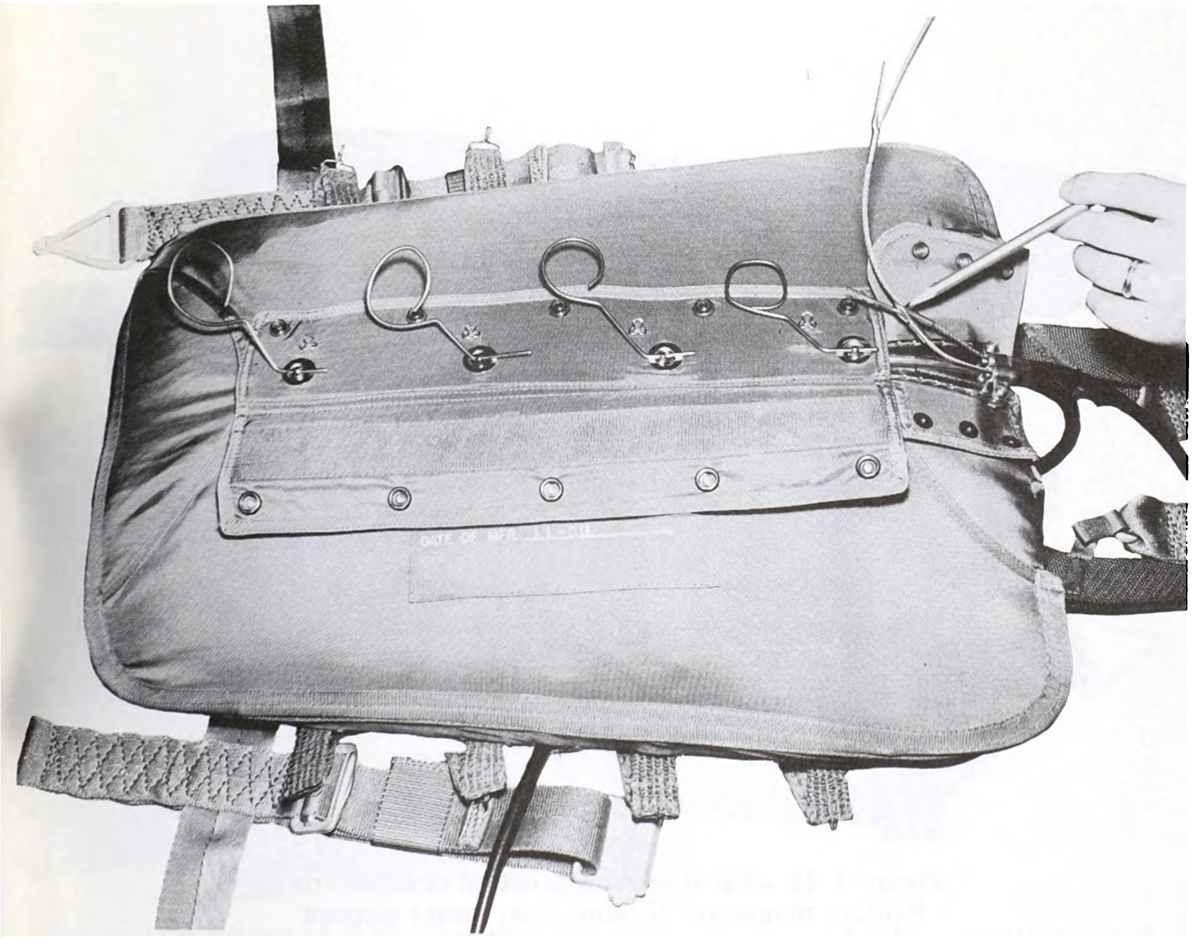


Figure 7-22.—NB-9 secured with temporary locking pins and power cable attached to top ripcord locking pin. Close top flap, using packing bar to insert end tabs; remove wrinkles, and insert top ripcord pin in automatic actuator power cable terminal eye.

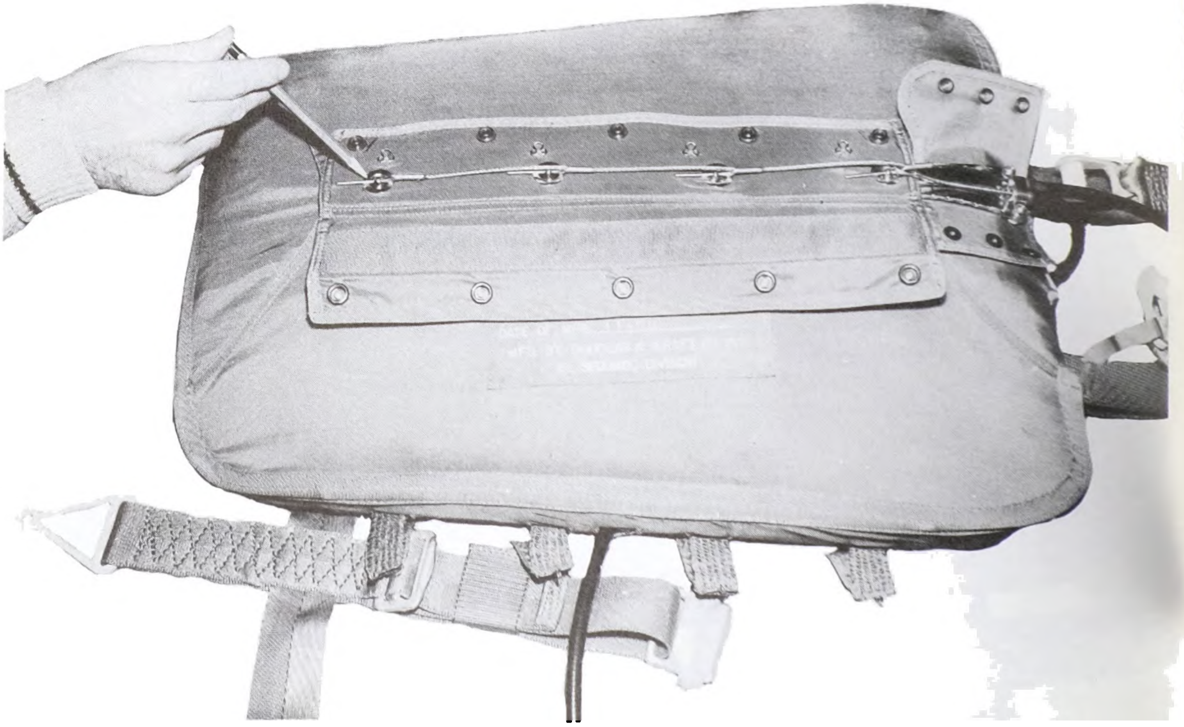


Figure 7-23.—NB-9 showing location of safety-tie. Remove temporary locking pins, insert ripcord pins, and safety-tie bottom pin with size A nylon thread.

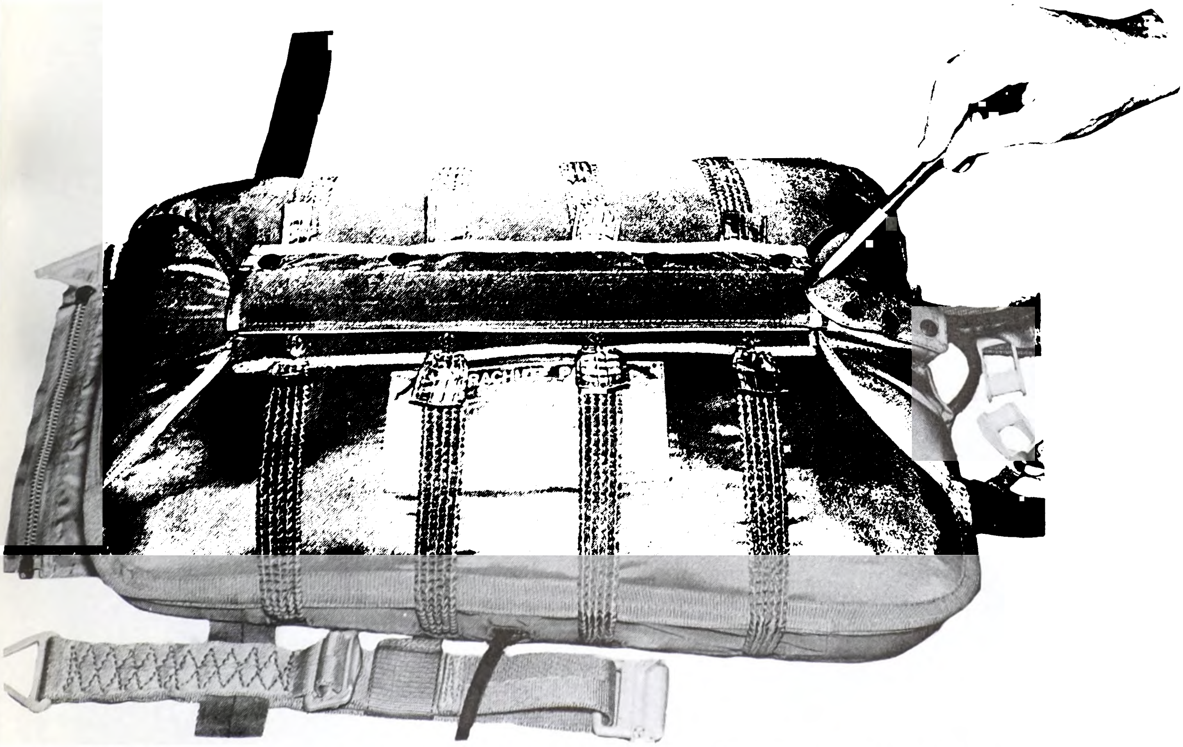


Figure 7-24.—Ripcord cable protector flap and pack opening bands properly secured. Hook up pack opening bands, close ripcord cable protector flap, and secure dual housing clamp cover. Edge of cover should be placed over ripcord protector flap.

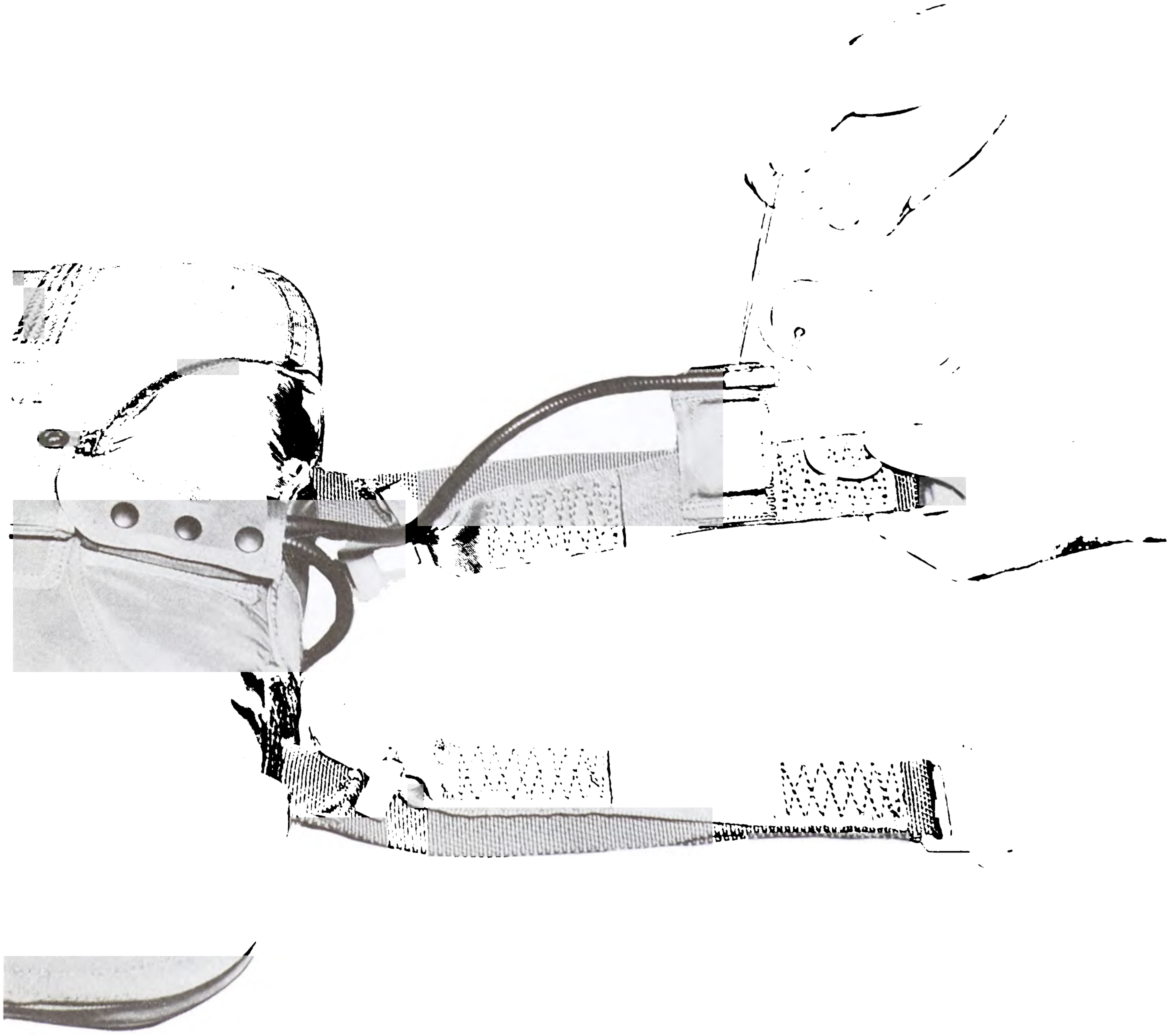


Figure 7-25.—NB-9 ripcord handle, showing location of retainer clip safety-tie. Insert ripcord housing in retainer clip. Safety-tie clip through both plies of webbing and through hole in clip. Use size A nylon thread for safety-tie.

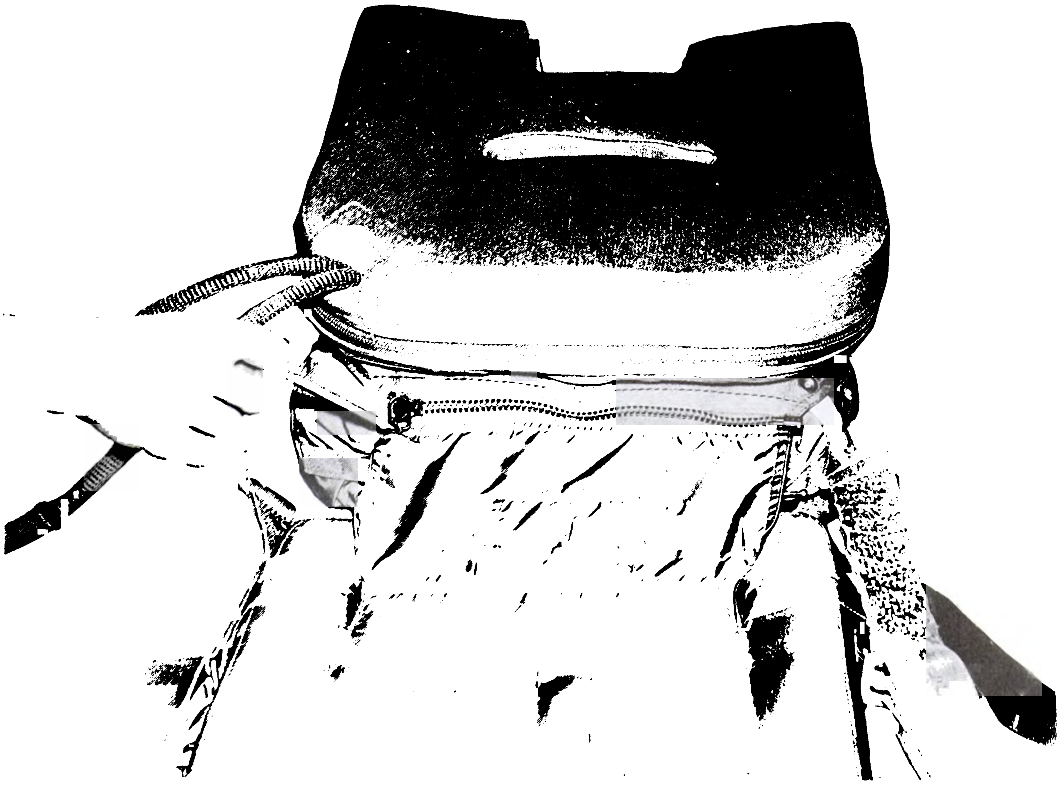


Figure 7-26.—High-speed pararaft kit container attached and safety-tied. Connect slide fastener located on flap on lower cushioned side of NB-9 to mating slide fastener on high-speed container.

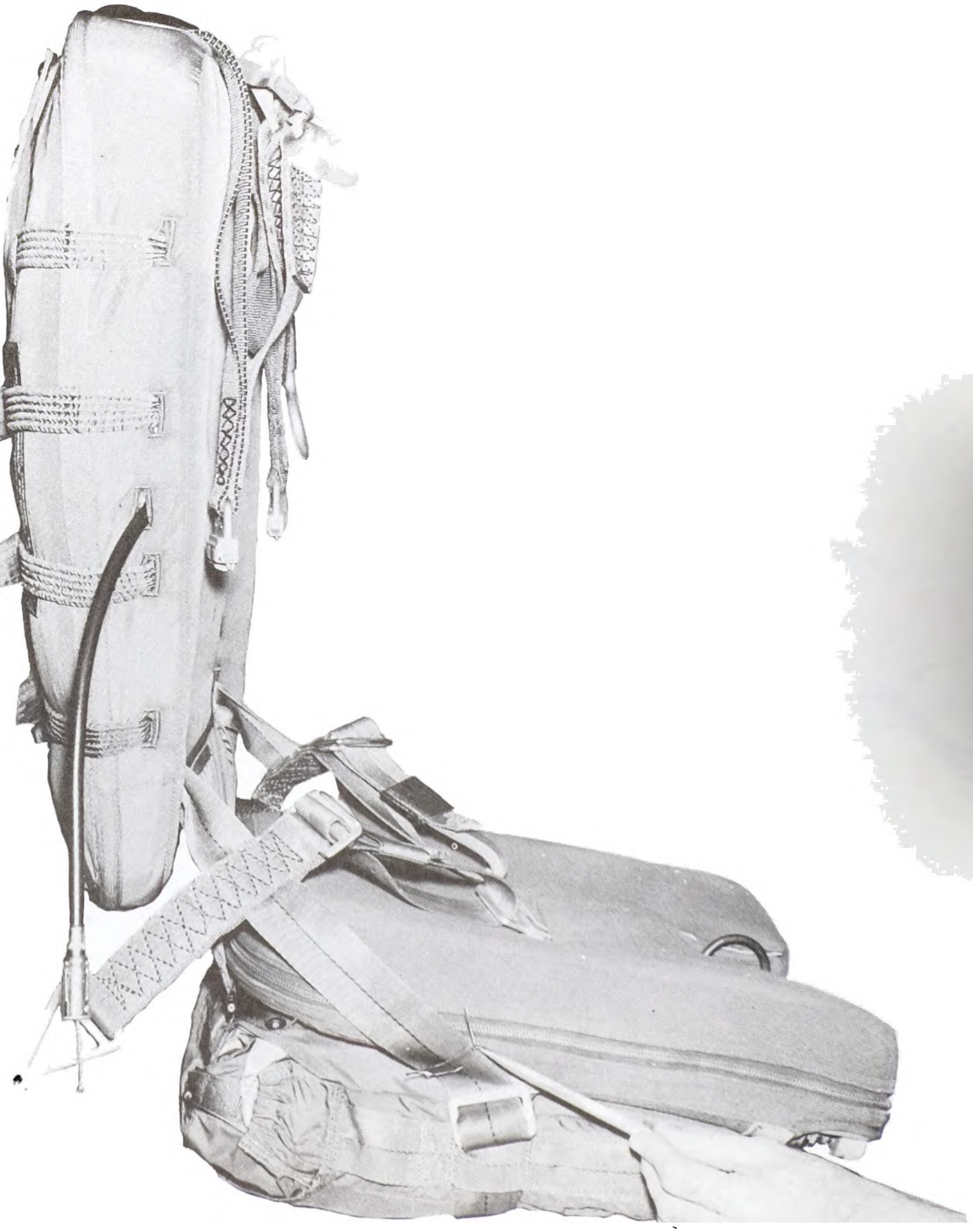


Figure 7-27.—Attach seat pan assembly. Thread type VIII nylon webbing straps at bottom of parachute through adapters located on both sides of seat pan assembly and pull taut. Free end of webbing should extend beyond edge of adapter approximately 1 1/2 inches (± 1/8). Safety-tie both webbing ends with two turns of 6-cord nylon.

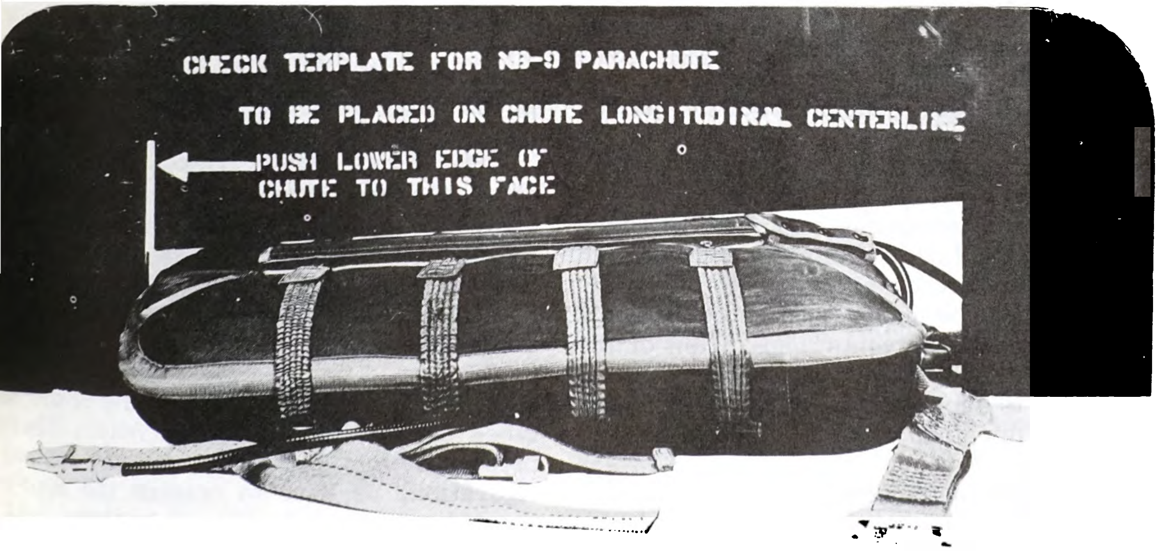

CHECK TEMPLATE FOR NB-9 PARACHUTE
TO BE PLACED ON CHUTE LONGITUDINAL CENTERLINE
PUSH LOWER EDGE OF CHUTE TO THIS FACE

Figure 7-28.—Check-template for NB-9. The NB-9 must be packed flat enough to pass beneath the check-template.

CHAPTER 8

PACKING AND RIGGING THE MARTIN-BAKER PARACHU

The Martin-Baker parachute is designed to be used with the Martin-Baker ejection system. The complete ejection system consists of an ejection seat, ejection gun, drogue gun, two drogue parachutes, time release mechanism, and personnel parachute and harness assembly.

The system is designed to provide safe escape at all altitudes and speeds, and after ejection, to automatically extract the personnel parachute and lift the occupant from the ejection seat.

Ejection at ground level during takeoff or landing when the airspeed is 100 knots or over is both safe and practicable because of the high ejection velocity of the ejection gun and the rapid extraction of the personnel parachute.

When ejection is made above 10,000 feet, a barostatic control prevents separation of the pilot and seat during the descent to 10,000 feet. The occupant is supplied with oxygen during the descent, and his drop is controlled by the stabilizer drogue.

Normal ejection is accomplished by pulling a face (blind) curtain. A secondary handle is located on the forward part of the seat bucket and is used if normal ejection cannot be effected. Either action causes the seat to be propelled upward by three successively fired cartridges operating in a telescoping ejection gun composed of three cylinders.

After ejection, the two drogue parachutes are deployed to stabilize and decelerate the seat. At the proper time, a time release mechanism causes the harness assembly to be released from its points of attachment to the seat and causes the drogue parachutes to be detached from the seat, permitting them to extract and deploy the personnel parachute. The personnel parachute then pulls the occupant in his harness from the seat.

Although personnel of the AME rating are responsible for the removal and installation of the seat and its components, the Parachute Rigger is responsible for packing and rigg both the drogue chutes and the perso parachute.

Personnel parachute packs of various sha are used with Martin-Baker parachute canopi The type of pack used depends on the des requirements of the seat and aircraft concern Two of these containers are the horseshoe the envelope. The most unusual of these ty is the horseshoe. Coverage in this section limited to the integrated horseshoe type.

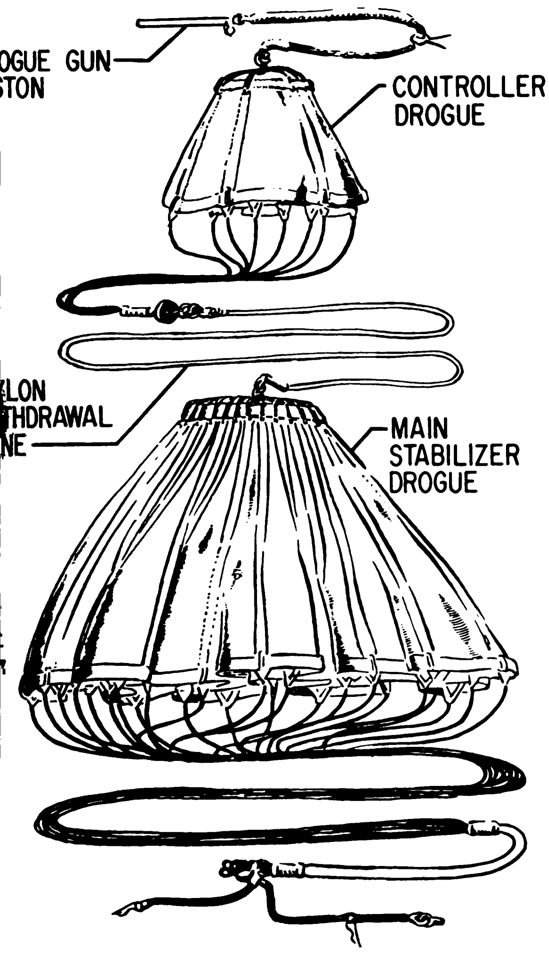
The Martin-Baker horseshoe pack is a ba type, secured to the seat by two restraini straps. It is shaped like a horseshoe to allo the shoulder straps to pass under the arch the horseshoe into the top lock of the inert reel while leaving the canopy free for clea extraction through the opening in the top of t pack.

Differences occur in packing of the vario types of Martin-Baker parachutes. Therefor before attempting to pack one of another co figuration, be sure to consult the appropria manuals covering the parachute and se involved.

DUPLEX DROGUE PARACHUTES

The drogue parachute assembly (fig. 8-1) comprised of two parachutes—a 22-inch diam eter controller drogue (small controller) and 5-foot diameter stabilizer drogue (ma stabilizer).

This assembly stabilizes and decelerates th seat with a minimum of altitude loss, and pos tions the seat in a convenient attitude for occupa separation. Upon actuation of the time releas mechanism, the main drogue parachute extrac the occupant's personnel parachute from i container, and releases the occupant's fa curtain restraints and personnel parachute slid disconnect static cable anchorage.



ure 8-1.—Martin-Baker drogue parachutes.

When the drogue gun is fired, the projectile nected to the controller drogue withdrawal) first pulls the drogue container spring pin, asing the four flaps. The pull of the pro- ile through the withdrawal line pulls the gue from the top of the container. The pull he deployed controller drogue extracts the ilizer drogue from its container by the drawal line connected to the apex. After loyment, the stabilizer drogue stabilizes decelerates the seat and occupant with a imum of altitude loss and positions the t into a convenient attitude for occupant aration.

The two drogue parachutes are fabricated of otton material and stowed in the headrest structure at the top of the seat. The controller drogue is packed on top of the stabilizer with a protective cloth sleeve between the two. The packed controller is attached to the controller drogue withdrawal line, and covered by four cloth flaps which are secured by a pin.

The face blind is stowed in a separate compartment at the front of the drogue parachutes container. The face blind handle cross tube is retained at each end by a spring-loaded pin which engages in a hole in the side of the container. The face blind straps extend aft through a channel-shaped housing within the container on each side and terminate in lugs which are retained by the link line pins. The face blind firing cable passes aft through the container and emerges between the flaps, together with a secondary firing cable.

REMOVAL AND INSTALLATION

In order to assure safe operation of the seat, it is essential that the drogue parachutes be properly packed, and that the lines are correctly routed.

The drogue parachutes should normally be inspected and repacked at intervals of 60 days, unless required more frequently by unusual circumstances. This work should be done only by personnel qualified in parachute handling. (Consult Parachute Manual NavWeps 13-5-501 for latest information on packing and inspection intervals.)

It is not necessary to remove the drogue parachutes to the parachute loft for repacking. It is recommended that this work be done indoors with a clean surface available on which the parts may be laid, but it may be performed on the aircraft if necessary.

The following safety precaustions must be observed:

1. If seat is not installed in the aircraft, check that the ejection gun is not with the seat and that the drogue gun is either unloaded (barrel removed) or safetied (safety pin in hole).
2. If the seat is installed in the aircraft, check that the safety pins are installed in the ejection gun sear and in the drogue gun safety pin hole.

The life of the face blind is 36 months after installation in the aircraft. The expiration date is stamped or stenciled on the face blind. The face blind should be replaced with a new one when the life period has expired. Expiration dates and replacements must be recorded in the aircraft logbook.

Removal of Face Curtain (Blind)

Retaining the safety pin in the ejection gun sear, push the sear forward and remove two firing cable eyes from the hook of the sear. This step is not necessary if the seat is not mounted on the ejection gun.

Remove the safety pin from the face curtain and stow in the clip on the seat pan.

Pull on the striped face curtain handle to extend the face curtain, then pull the firing cable forward through the hole in the container.

Pull the link line pins out of the fittings at the sides of the container to free the lugs at the ends of the face curtain restraining straps. The face curtain may now be removed from the seat. This step is necessary only if it is desired to remove the face curtain from the seat.

Removal of Drogue Parachutes

Disconnect controller drogue withdrawal line from the drogue gun piston by removing the nut and bolt. Temporarily replace the bolt and nut in the small shackle.

Break and remove the safe-tie thread on the flap securing pin.

Pull the flap securing pin out of the flap pocket and out of the wire loop on the flap. The pin will also be pulled out of the shackle safe-tie loop. This loop of nylon line may be reinstalled later if not damaged.

Lift up the scissor and shackle to a vertical position.

Placing the secondary firing cable to one side, fold back the four flaps and pull out the controller drogue by means of its withdrawal line.

Pull out the protective sleeve and remove the stabilizer drogue by pulling on the withdrawal line.

Note that the drogue shackle is still held in the scissor and retains the stabilizer drogue suspension lines. It is not necessary to break this connection; but if it is desired to remove the drogue parachutes from the seat, proceed as follows:

1. Unscrew the link line connector, if the personnel parachute is installed.
2. Operate the time release mechanism by pulling the trip rod sear. Keep hands away from descending plungers to avoid injury. After operation, replace the trip rod sear fully home in the time release mechanism.
3. Open the scissor and remove the shack
The link line will also be removed, as it is
tached to the shackle.

Examine the drogue parachutes, suspens
lines, withdrawal lines, shackle attachmen
etc., for evidences of possible deteriorati
Take corrective action if necessary.

Clean the inside of the drogue parach
container.

Packing Stabilizer Drogue Parachute

Open the four flaps. Pull up the protect
sleeve and roll it down so that it does not
struct the packing.

If the drogue shackle has been removed fr
the scissor, proceed as follows:

1. Place the shackle bolt within the ja
and close the scissor. The link line should
forward and the eye of the stabilizer drog
suspension line should be aft.
2. Cock the time release mechanism.
shackle will then be retained in the scissor.

Holding the stabilizer drogue, extend
suspension lines from the shackle and straight
them out, so that they are not twisted or tangle

Pair off the 24 suspension lines and fold
skirt into 6 double folds. (See fig. 8-2.)

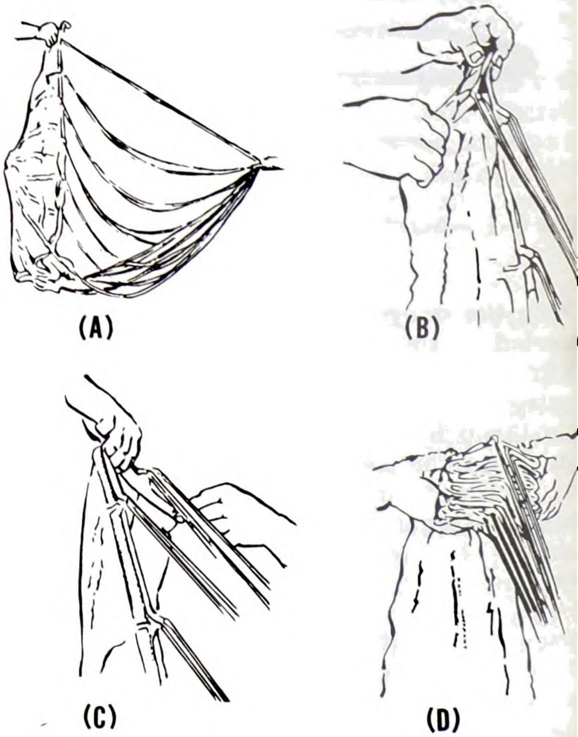


Figure 8-2.—Pairing suspension lines.

Iolding the folds as shown in view (D), stow suspension lines as follows:

. Lead the sleeve protected portion from shackle down the right aft corner of the ainer.

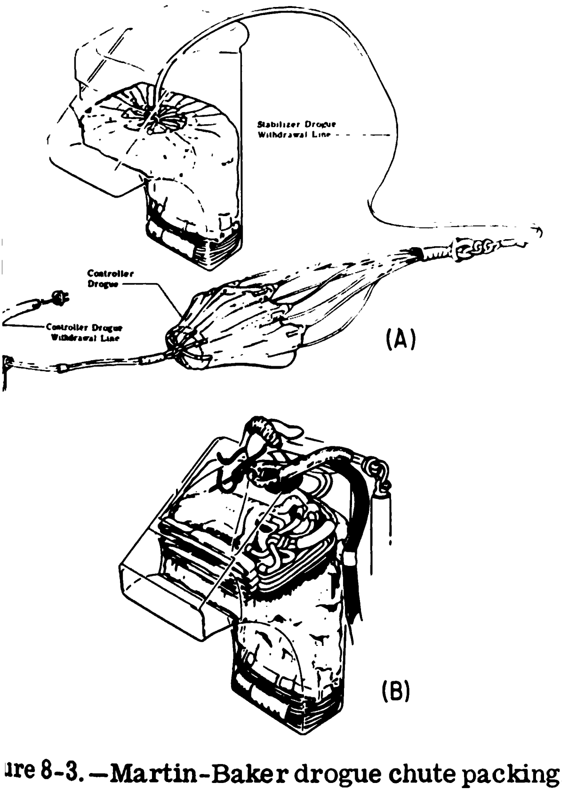
. Stow the remainder of the suspension lines ie bottom of the container by looping them i side to side.

tow the stabilizer drogue on top of the susion lines. Insert the skirt first and pack parachute in accordion fashion well down the container. The apex remains on top. fig. 8-3 (A).)

Jnroll the protective sleeve and pack it down the container to cover the stabilizer drogue. he same time, bring the withdrawal line out he right aft corner of the container, toer with the suspension (shackle) line.

king Controller Drogue Parachute

Iolding the controller drogue, extend the ension lines and the stabilizer drogue withal line and straighten them out, so that are not twisted or tangled.


Stabilizer Drogue Withdrawal Line
Controller Drogue
Controller Drogue Withdrawal Line
(A)
(B)

ure 8-3.—Martin-Baker drogue chute packing.

Pair off the 10 suspension lines and fold the skirt into 3 single folds.

Holding the folds, stow the lines as follows:

1. Folding the withdrawal line into about 7 folds, place it in the front part of the container.
2. Loop the suspension lines over the remainder of the protective sleeve.

Fold the apex of the controller drogue on top of the skirt and stow in the container with the apex toward the left rear corner of the container toward the drogue gun, then pack it down. (See fig. 8-3 (B).)

The controller drogue withdrawal line must emerge from the left rear corner of the container toward the drogue gun. Loop the line behind the parachute so that 3 inches of line are exposed beyond the flap securing pin.

Closing Flaps and Stowing Face Blind

If the face blind has been removed from the seat, proceed as follows:

1. Bring the face blind up to the headrest with the firing cable on top. (See fig. 8-4.)
2. Push the strap lugs back through the housings on each side and locate the lugs in the fittings for the link line pins, being sure the straps are not twisted.
3. Insert the link line pins into fittings at sides of the headrest, making sure that they pass through the lugs of the face curtain restraint straps and the lugs of the parachute restraint straps, if installed.
4. Mate or connect the link line connector, if removed, and personnel parachute is installed.

Pass the face curtain firing cable through the hole in the center of the container and lead aft. During this operation, push the packed parachute down with the finger to assure that there is no entanglement.

Fold the undersides of the face curtain to the width of the container mouth.

Fold under the stitched aft end of the face curtain and insert it into the container.

Close the right, left, rear, and front flaps—in that order. Be sure that the wire loop on the right flap extends up through the grommets on the other three flaps. During this process make certain that the two firing cables pass under the front flap and over the rear flap.

Fold the scissor and shackle forward and down on top of the flaps.

Insert the points of the flap securing pin (on withdrawal line) through the wire loop of the flaps, then through the shackle safe-tie loop, and finally into the pocket on the front flap.

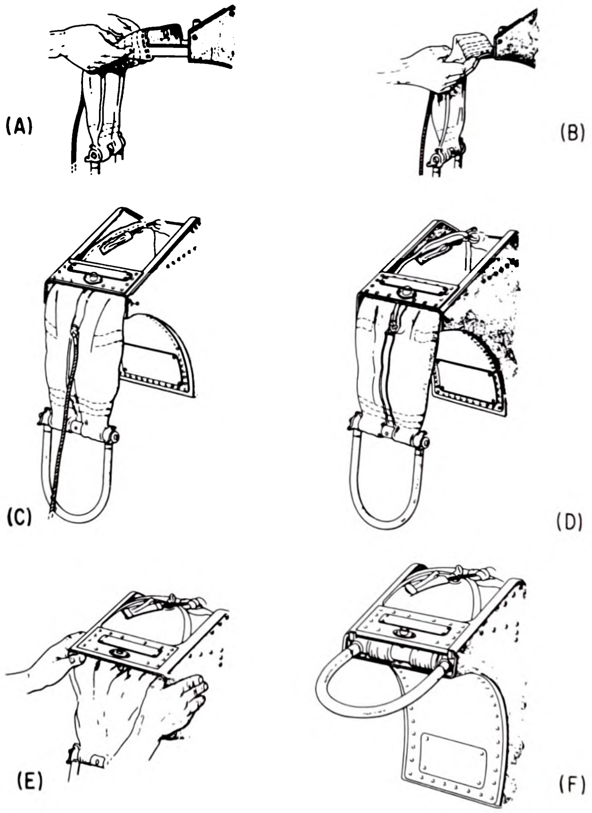


Figure 8-4.—Stowing face curtain (blind).

NOTE: If it should be necessary to replace the shackle safe-tie use single nylon 6-cord Spec. MIL-C-7807 Type I or II, and tie the loop with a square knot. The loop must pass under the flap securing pin (not through it) between the wire loop and the pocket. The scissor and shackle must be free to lift up when the pin is pulled out by the withdrawal line.

Safe-tie the flap securing pin with a single loop of 6-core nylon, through the eye of the pin and through the loop on the flap pocket; then tie with a double square knot.

Stow the remainder of the face curtain into the container and, using the thumbs, pack firmly into the sides.

Push the cross tube of the handle into the container, first one side and then the other, retracting the pins in turn. Make sure that the pins extend into the fittings on each side.

Install the face blind firing handle safety pin.

Connect the controller drogue withdrawal li to the drogue gun piston with the bolt and nut the small shackle.

WARNING: It is essential for safe operati of the seat that the withdrawal line be rout over the link line and not under it, so that t withdrawal line is free to extract the controll drogue without entanglement.

MAIN PARACHUTE CANOPY

A standard, Irvin 24-foot personnel parachu is used with the Martin-Baker ejection se The parachute and lift web assembly normal remain installed in the aircraft, except wh removal for packing of the chute or servici of the seat is required.

This section describes the procedure f packing the personnel parachute into the hors shoe pack. Before beginning the packing, che that the pack zippers are open, that pack openi bands are released, and that loose threads a removed. Any parachute in service is requir to be repacked every 60 days as specifi in applicable directives. (Consult Parachu Manual, NavWeps 13-5-501 for latest packi and inspection intervals.)

PACKING AND RIGGING

Lay out the parachute on the table with N 13 gore on top. Extend the suspension lines a separate them into two groups.

NOTE: The gore marked No. 1 (the go which bears the label) is the bottom center go and the gore marked No. 13 is the top cente Attach the apex of the parachute to the hook the head of the table by means of the loop the pilot chute connector cord.

Lay out the lift webs on the table with go No. 13 on top of the canopy and no twists in t suspension lines. The connector links will ha the snap fasteners down and be in position attach to the tensioning device. (See fig. 8-5.)

Locate suspension lines No. 12 and 13. Fo low these lines down to the connector lin (these lines must be on the inside of the upp links). Place the links on the tensioning devic

Grasp the left and right paired groups lines and follow them up to the skirt of the para chute to assure that there are no twists. twists are found, pull the pack and lift web as sembly through the lines until straight. (Se fig. 8-6.) Pull the tensioning device strap

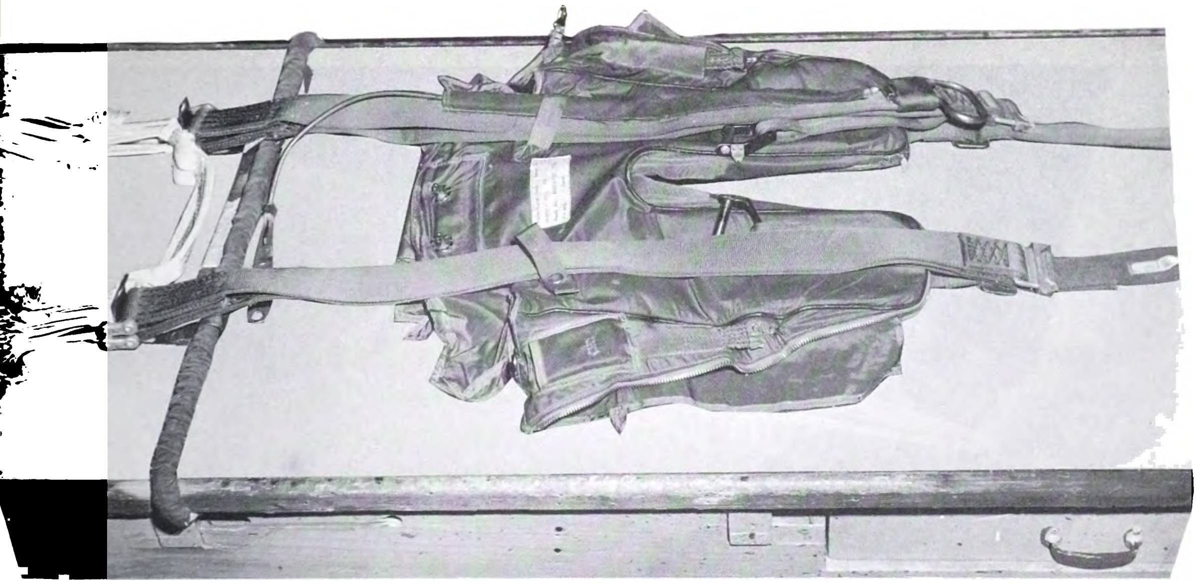


Figure 8-5.—Layout of webs for packing.

t (approximately 50 pounds tension). Check the lines at the apex are even and that the is straight with approximately the same th of line on each side of the loop in the nector cord.

ing the Canopy

The canopy is whipped and folded in the same ner as outlined in chapter 5 for packing NC-3 parachute. After whipping and folding gore of the parachute, fold each group of ve gores in a double fold at the skirt, divid- the canopy into three parts as shown in re 8-7. Place a shot bag on the folds near skirt.

Extend the double fold on each side, holding folded width to a minimum by keeping the es of the folds parallel up to the point where folds run out (about 4 feet from the apex). e another shot bag across the canopy to the upper part of the folds in place while inuing the packing process. (See fig. 8-8.) nove the tensioning device.

uring Main Lift Webs

Place the pack in position on the table, lock- cones up. Lay the lift webs on top of the k in a manner which will place the four snap fasteners on the lift webs in position to be snapped to the corresponding studs on the pack.

The connector links are paired together as sets and tied together by passing one turn of FF thread around the outboard sides of the links and tying with a surgeon's knot. This tying is made on both right and left sets of lift webs. (See fig. 8-9.)

Pull the parachute toward the skirt and place the lift web through the slot provided on the container. Attach the snaps of the lift webs to the studs on the pack as shown in figure 8-10.

Stowing Suspension Lines

With the parachute pack completely unzipped and open, begin stowing the lines in the loop nearest the connector link. Pull the bight through the first two loops so that the loops of the suspension lines will be toward the inside of the leg of the pack when it is folded back over for closing. Then route the lines to the bottom center of the leg and take a bight through loop No. 3. Continue stowing by pulling a bight alternately from one side to the other through all the loops in one leg.

Repeat the same process for the lines in the opposite leg. Figure 8-11 illustrates the lines as stowed in one leg of the Martin-Baker pack.

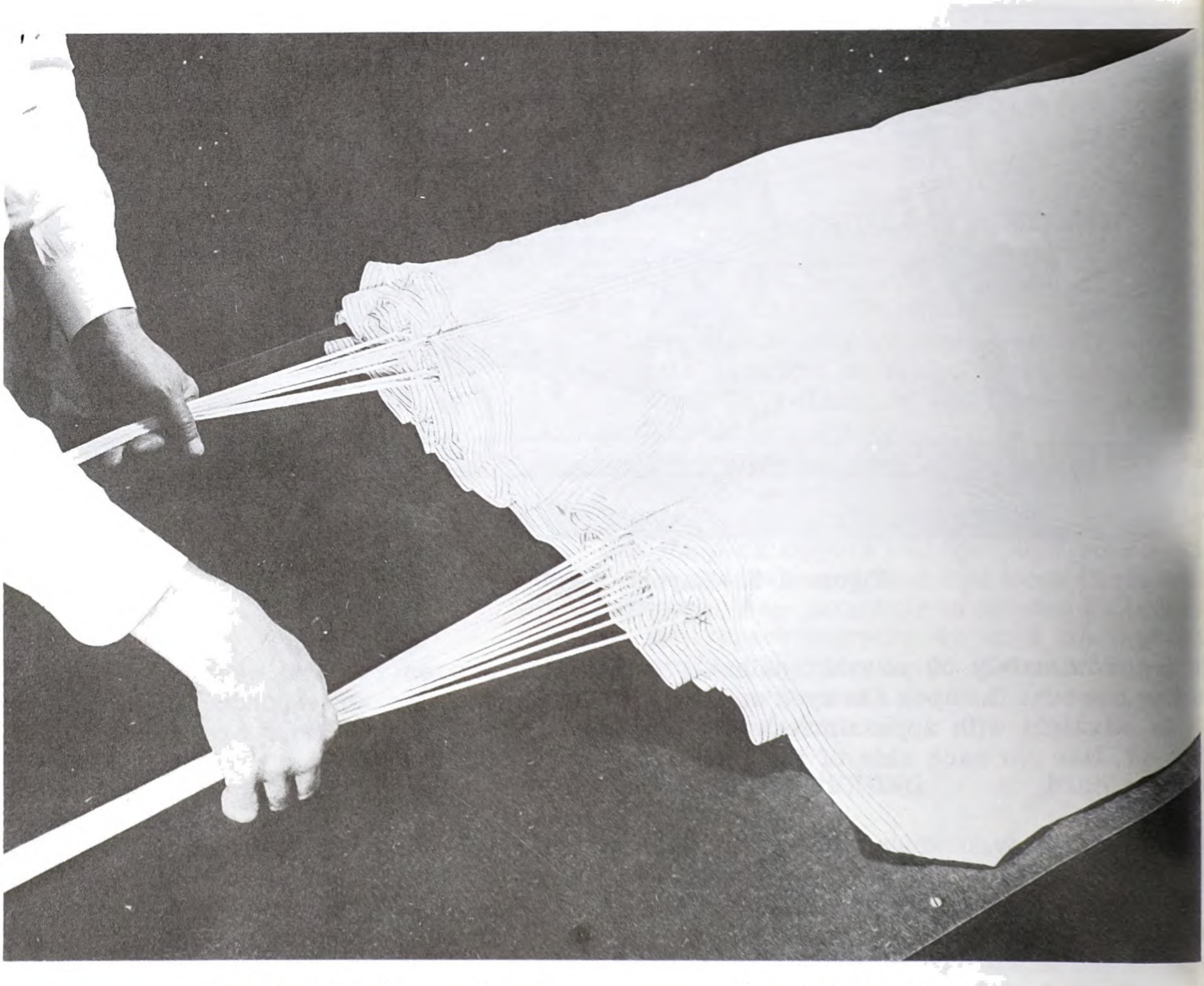


Figure 8-6.—Separating the two groups of suspension lines.

After stowing the lines in both legs, bring the two groups of lines together at the arch of the pack. If the lengths of the two sets of lines are uneven to the skirt, place the junction off center toward the side which is shorter, and stow the remainder of the suspension lines in the loops which are outside the legs. (See fig. 8-12.)

On one side, close the protective flap over hesitator loops 1 and 2, pass a length of FF nylon thread through each of the loops on the flap and through the corresponding loops on the pack, and tie with a square knot. Tie the flap covering loops 3 through 13 in the same manner, then repeat the entire process for the opposite leg of the pack. (See fig. 8-13.)

Remove the lower shot bag and bring t canopy over the pack with the skirt touchi the arch of the horseshoe.

Stowing Lower Canopy

Grasp all gores except Nos. 1 and 13 ne the center. While retaining the double fold the other gores, pull this half of the skirt do to a position about 4 inches from the bottom the pack leg as illustrated in figure 8-14.

Grasp the top part of the double fold at t side and pull the skirt down to the bottom the pack leg in a telescopic fashion so as finish in a taper. (See fig. 8-15.)

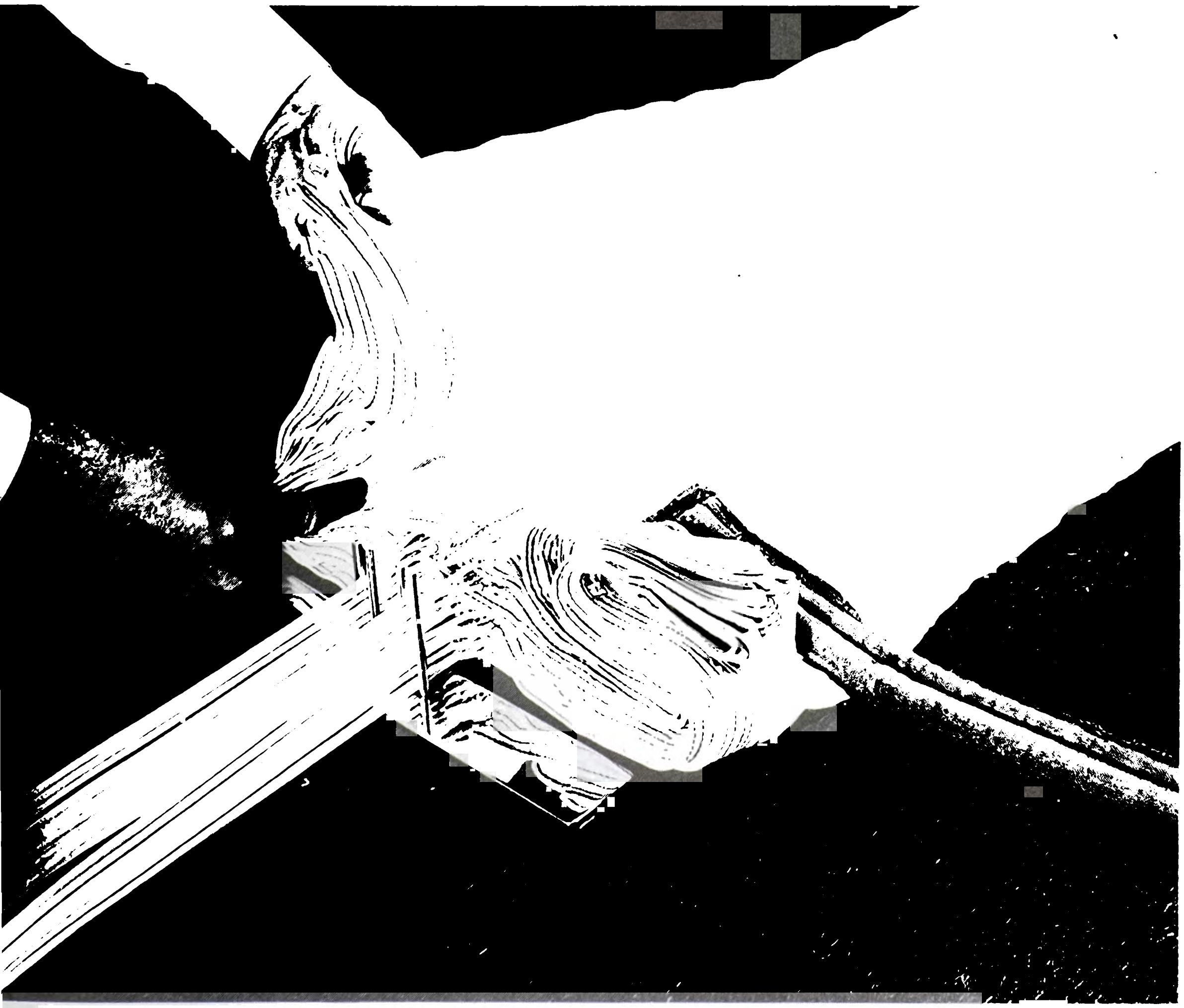


Figure 8-7.—Folding each group of gores into double folds.

lose the slide fastener at the bottom, tuck- he parachute in carefully to make sure that not caught in the teeth of the slide fastener. the protective flap up between the fabric e canopy and the slide fastener and close 6 inches of the leg of the pack. Repeat ame procedure for the opposite leg of the (See fig. 8-16.)

ng Upper Canopy

hile keeping the double folds of the canopy t, grasp the canopy and begin making ac- on folds across the upper section of the pack. Make sure that the legs of the pack are filled out firmly. Make the folds the full width of the pack in the manner shown in figure 8-17.

When the entire canopy is properly folded into the top of the pack there will be approximately four folds with the apex lying nearest the left side. The suspension lines which emerge from the apex should be folded across the vent and brought back to the right side. Lead the parachute withdrawal line off to the right and the pilot chute connector cord to the left.

Place a shot bag across the folded canopy to hold it in place. Sign and insert the packing

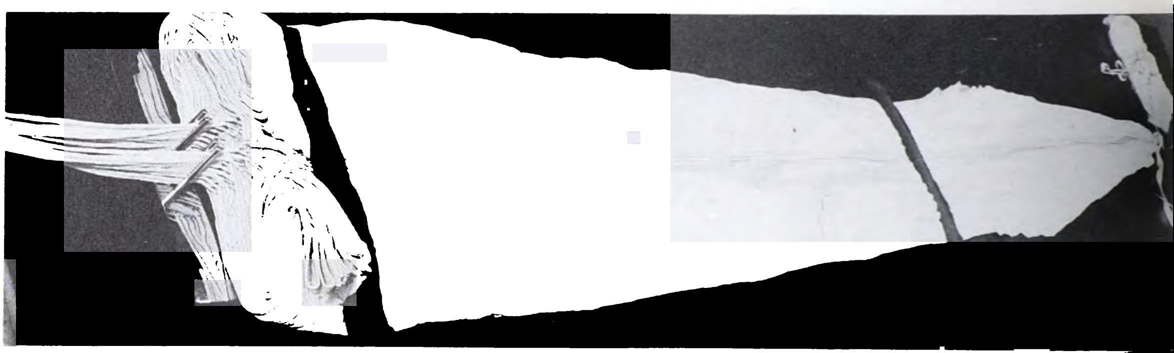


Figure 8-8.—Extending the folds of the canopy.

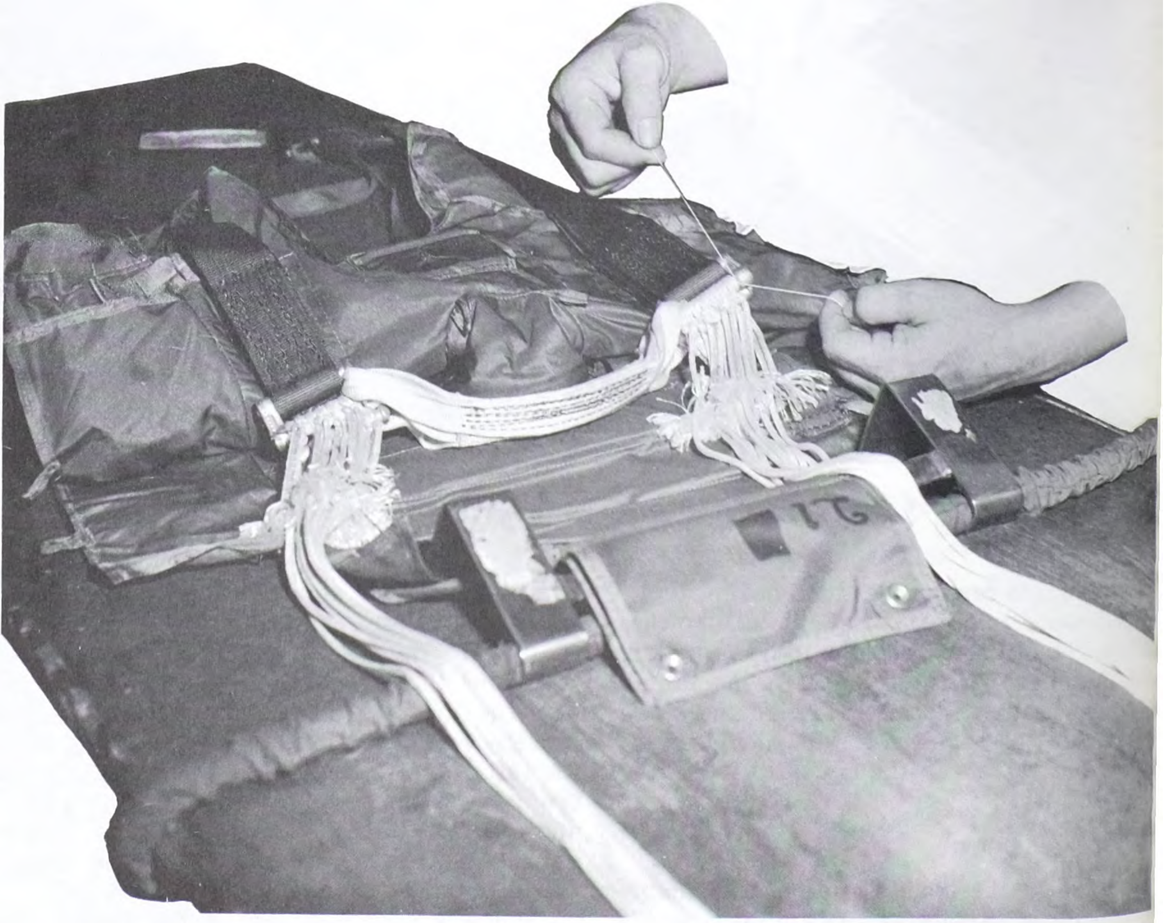


Figure 8-9.—Tying connector links.

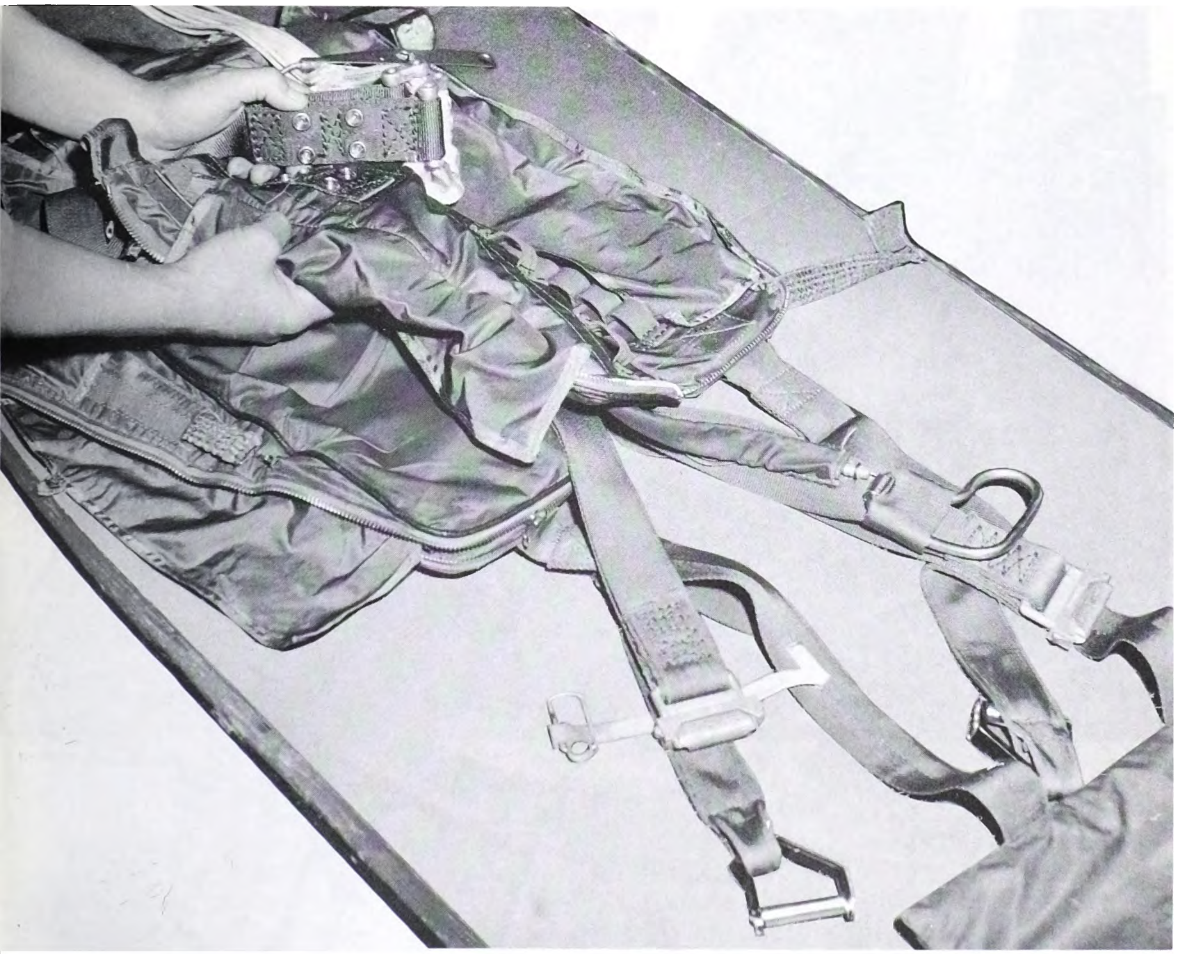


Figure 8-10.—Attaching lift webs.

rd card in the inside pocket located on the de front of the pack.

rting Pack Stiffener

nsert the pack stiffener into the pocket pro- d, and secure into place by tying the nylon s which are attached to the pack. The ex- length of these cords may be tied back out he way by tying a double bow knot in the . (See fig. 8-18.)

ing Side and Top Flaps

uck the upper part of the canopy into the . First, bring the inner back flap over the chute, next the front, and then the back flap. Place a shot bag over the pack and proceed to completely close the slide fasteners on each leg.

NOTE: Closing the pack and placing the shot bag across it in the above manner will hold the folded canopy in place while closing the zippers.

It is important when closing the zippers to make sure that the protective webbing is in position on the inside of the fastener so that the canopy does not become enmeshed in the teeth of the zipper.

Place the pack on the packing stand. This will assist in keeping the pack in position while tucking in the flaps and making the final steps in completing the packing operation. (See fig. 8-19.)

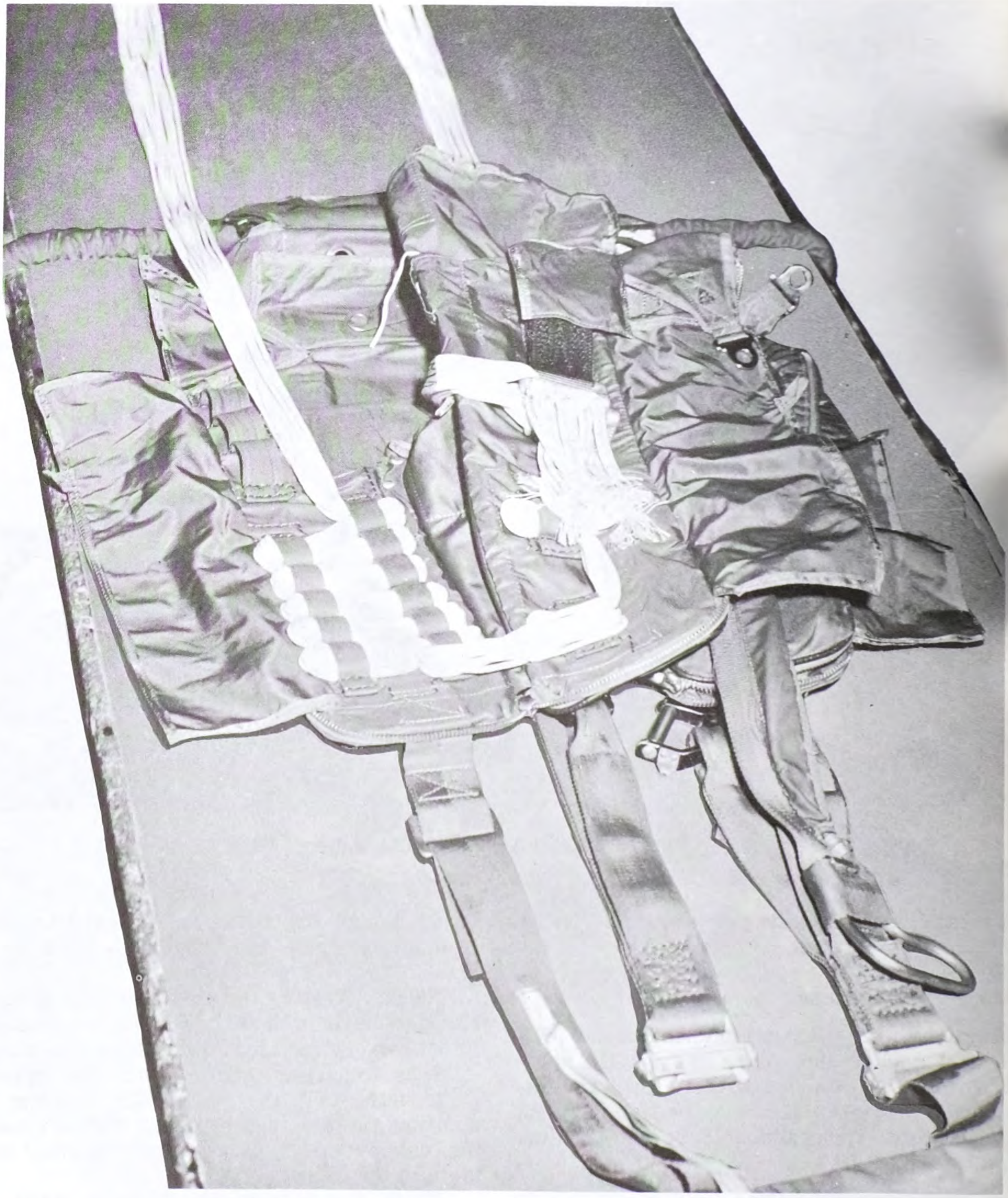


Figure 8-11.—Suspension lines stowed in leg of pack.

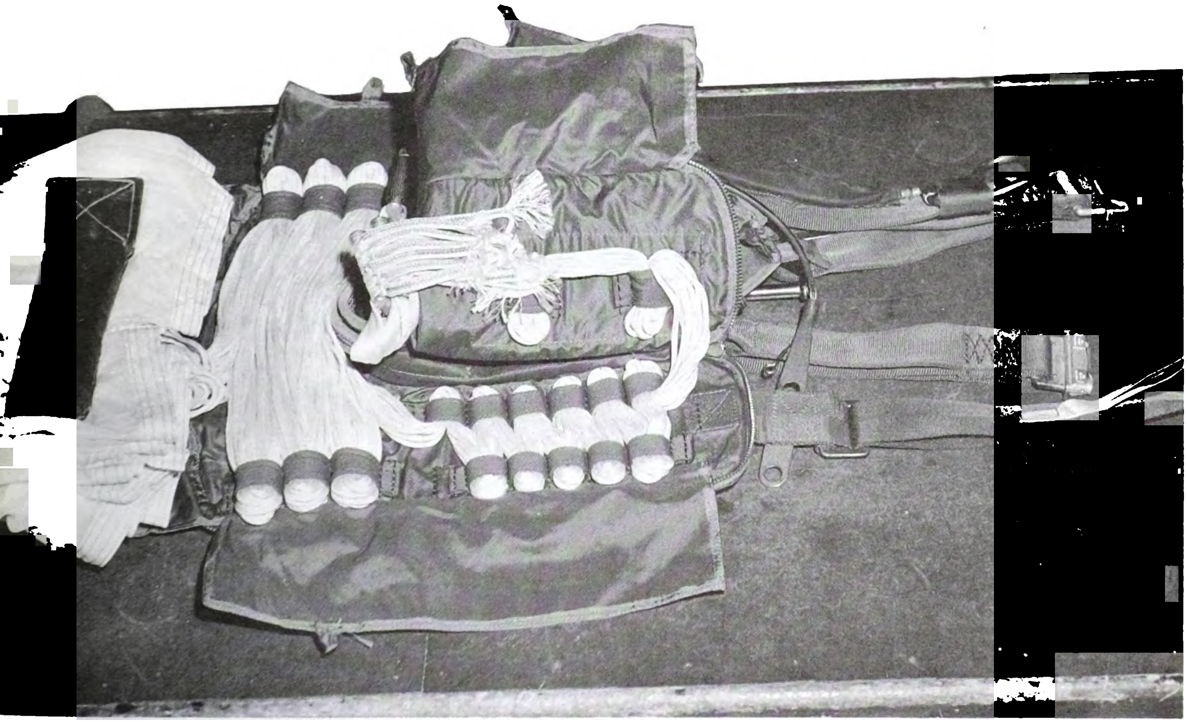


Figure 8-12.—Suspension lines completely stowed.

Tuck the canopy well down into the pack, king sure that the withdrawal line emerges n the pack on the ripcord side.

Pull the inner back flap over on top of the ed canopy and pull the front flap which ries the locking cones over it. Place the tor board so that it lies on top of both front back flaps.

Pull the main flap forward, fit the grommets r the cones and insert the temporary locking s into the cones. Tuck in the left side corner he front inner flap, lift the withdrawal line, place the small triangular flap on top of the er flap. Replace the corner of the main flap op of the withdrawal line. Bring up the port- e flap, remove the temporary locking pin, place the end tab over the cone. Replace temporary locking pins.

Place the ripcord pins (attached to the with- wal line) in position alongside the locking es. Open the slide fastener on the left side ut 5 inches down the side of the pack and rt all excess length of the withdrawal line. lose slide fastener.

Insert the rear ripcord pin through the eye on the end of the ripcord cable. Remove the temporary locking pin from the rear locking cone (cone nearest the end of the ripcord cable) and place the cable securing plate in position over the locking cone. Insert the rear ripcord pin through hole in rear locking cone. (See fig. 8-20.)

Folding and Inserting Pilot Chute

Check the pilot chute suspension lines for dips and twists, then lay the canopy on the table with the suspension lines up. Let the folds of the canopy fall in over the ribs of the spring in a manner which forms a square of the folded canopy. With the tips of the spring ribs serving as corners of the square, place the connector cord and folded suspension lines diagonally across the canopy of the pilot chute.

Grasp the two ribs of the pilot chute lying parallel to the connector cord. Close these ribs in together, then pull up the other two ribs in the same manner. Hold the folded canopy and

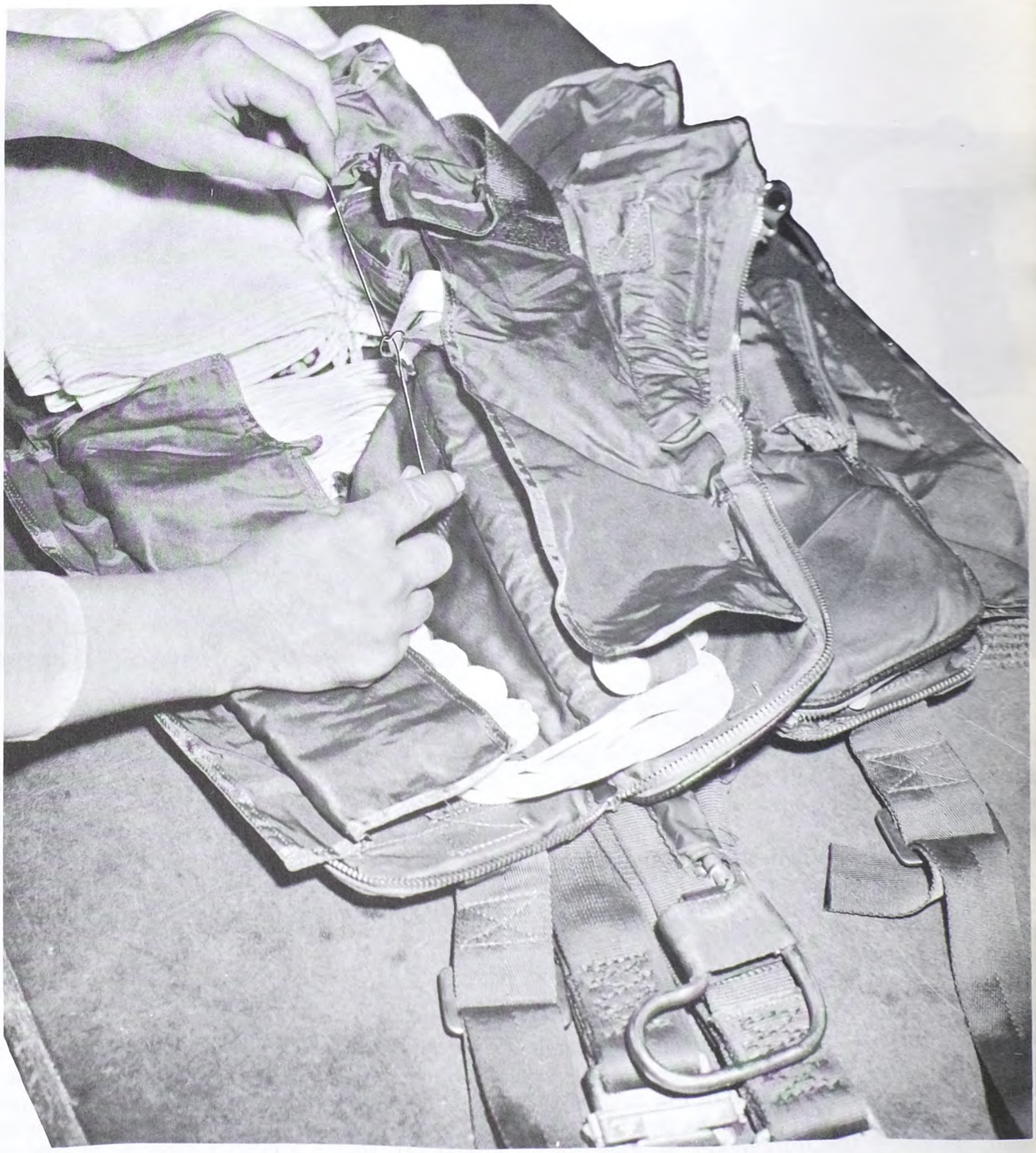
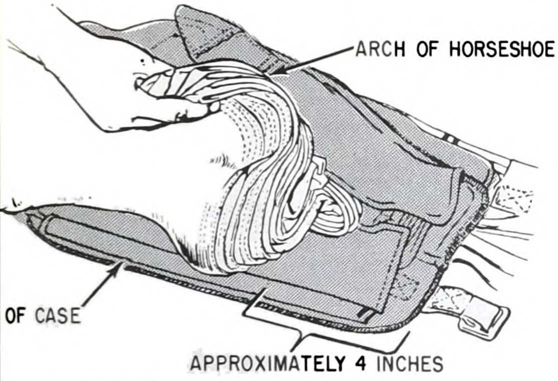


Figure 8-13.—Tying protective flaps over suspension lines.

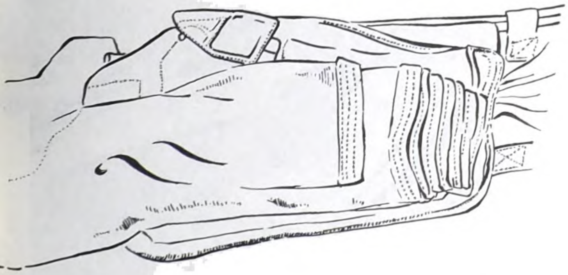
ribs in one hand, pull the canopy out between the ribs into four triangular folds, and insert into the pack on top of the ejector board. Fold the remainder of the connector cord and tuck in under the ejector board.

Completing the Pack

Place the right-hand grommet over the c
pull up end flap, and place end tab over
cone. Position the cable securing plate



igure 8-14.—Skirt placed 4 inches from bottom of leg.



ure 8-15.—Half of the skirt pulled to bottom
leg in telescopic fashion to form a tapered
ish to the leg.

rt the starboard locking pin into the hole
he cone. Safety tie the right-hand locking
in the same manner as prescribed in chapter
r the NC-3, using size A thread.
Fold the ripcord pin protector flap back on
of the locking cones, then fold the withdrawal
in a loop on top of the flap. Fold over the
outer flap and secure the two snap fasteners.
Hook up pack opening elastics.
Make sure that ripcord handle is installed
rectly in the spring clip with handle facing
oard of the lift web. NOTE: The ripcord
the integrated Martin-Baker parachute dif-
from ripcords for the conventional Navy
achutes in that an eye is swaged to the end
the cable which would normally have the
cord pins attached. The cable housing also
differs from other housings in that it is smaller in diameter, has a protective covering of a green plastic type substance, and has a cable securing plate attached to the free end.

The ripcord handle end of the cable housing is attached to the left-hand lift web at a point near the rocket jet fitting and then reeved through a nylon canvas channel sewn to the edge of the lift web. As it emerges from the channel, the end of the cable housing is a free end until the cable securing plate is set over the cones and held in place by the locking pins.

PERSONAL SURVIVAL KIT

Survival equipment kits are now being tested which will tend to standardize survival kits for all types of aircraft. These kits are the rigid seat survival kit (such as the one described in chapter 14 for use in aircraft utilizing ejection seats) and the "soft pack" kits for use in non-ejection type aircraft. Although in the future no "soft pack" kits are to be used with ejection seats, the one described in this chapter has been used until recently with certain of the Martin-Baker ejection seats. Before attempting any maintenance work on these survival kits be sure to consult the Maintenance Instructions Manual covering the aircraft and seat concerned.

The "soft kit" consists of two assemblies: the seat pan assembly and the survival kit assembly.

SEAT PAN ASSEMBLY

The seat pan assembly is designed to provide an emergency oxygen breathing supply to the pilot during ejection at high altitudes and, when the pilot is using a full pressure suit, to maintain pressurization corresponding to an altitude of 35,500 feet. The system is automatically actuated upon ejection or may be manually actuated by the pilot. A gage installed at the upper left front of the seat indicates the oxygen supply pressure. This system also furnishes pressurization and oxygen breathing supply in the event of a failure of either system in the aircraft. The seat pan contains the pressure suit controller assembly, which controls the suit pressure both during normal flight and ejection. The seat pan assembly incorporates provisions for the attachment of the survival kit, as well as the shock and comfort pads.

SURVIVAL KIT ASSEMBLY

The survival kit consists of survival equipment in a special container assembly. The

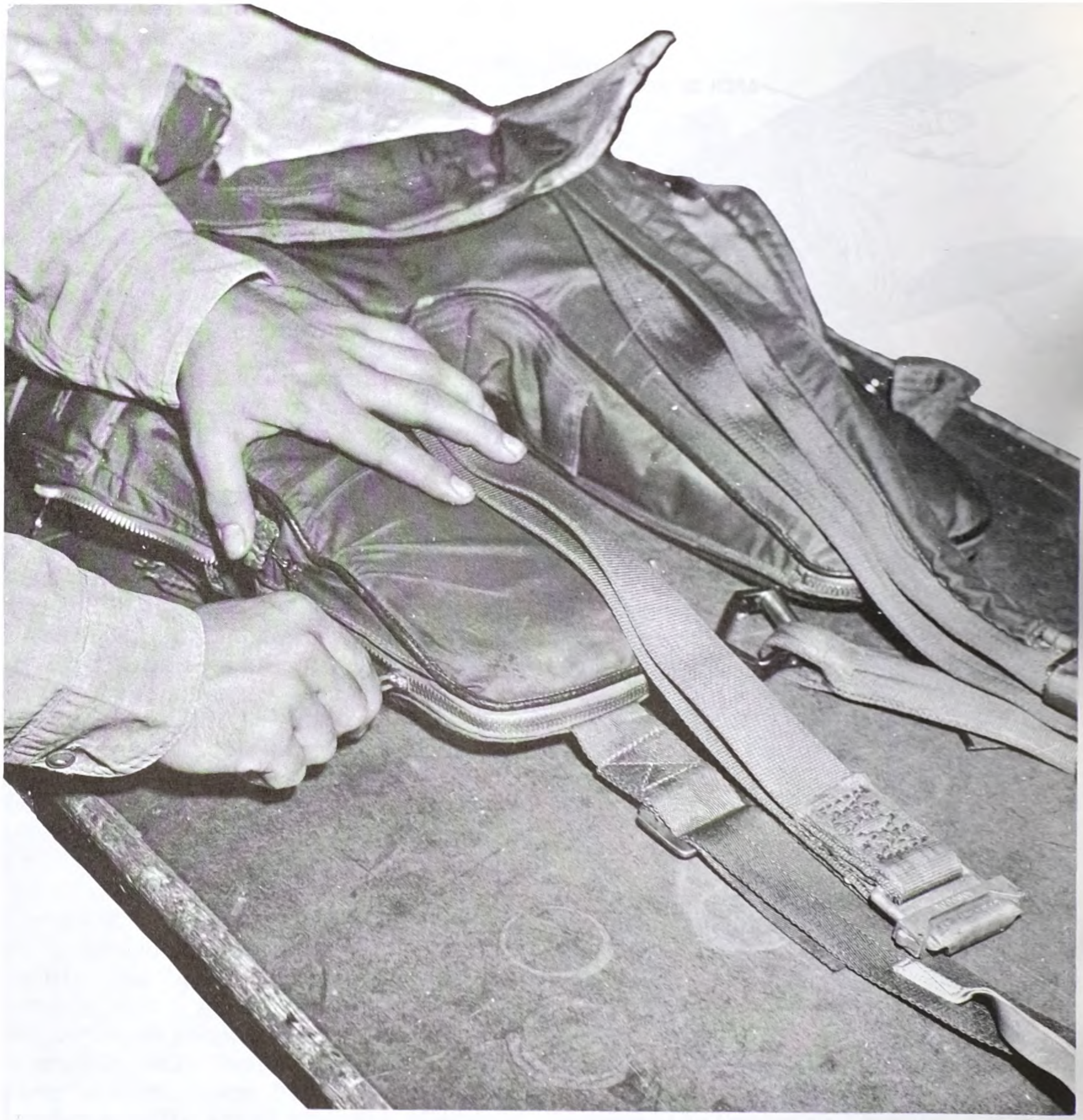
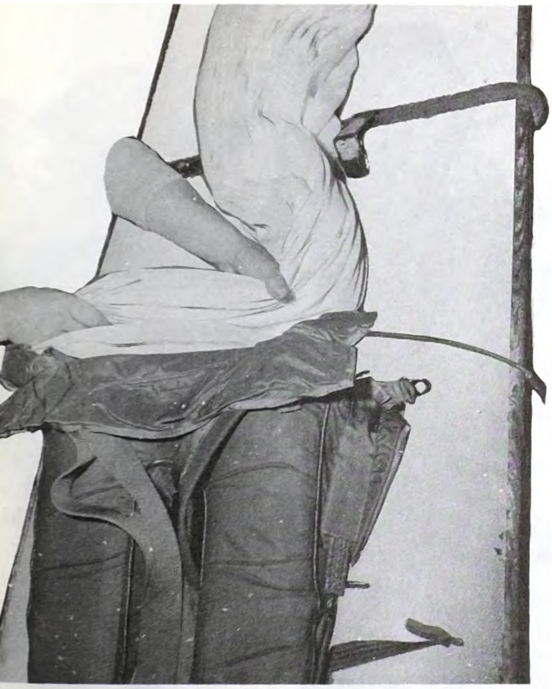


Figure 8-16.—Close slide fastener approximately 6 inches.

equipment kit contains survival gear to sustain the pilot in the case of an emergency. This gear includes the following:

PK-2 pararaft.
Equipment container.
Water storage bag.
Radar reflector or appropriate pilot's emergency beacon.
Nylon cord (50 feet).
Dye marker.
Desalter kit.
Solar still.
Signal mirror.
Bailing sponge.
Poncho.
Rations.
Ointment.
Sea anchor.
Inflation cylinder.
High-speed container.

The PK-2 pararaft and CO_2 bottle fill aft section of the equipment kit and are connect



igure 8-17.—Accordion folding canopy into pack.

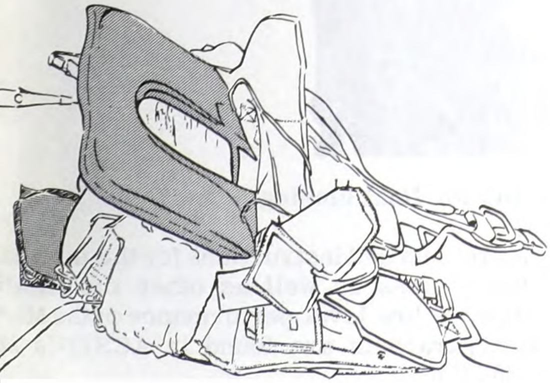


Figure 8-18.—Inserting pack stiffener.

a line to the zipper ring of the survival kit. container assembly flaps are folded inward protect the pararaft and CO_2 bottle and are ured by a ripcord assembly. The ripcord embly pins secure the outer flap of the coner on locking cones. A lanyard from the cord assembly to the CO_2 bottle manifold pulls the bottle and pararaft from the container when the ripcord is pulled to open the container assembly. A release cord on the CO_2 bottle must be pulled to inflate the raft. The survival kit is strapped to the seat pan and is stowed in the seat bucket beneath the seat pan.

NOTE: The contents of the survival kit as listed above are considered as typical of a survival kit and substitutions may be made as directed by local authority.

A typical personal survival kit is shown in figure 8-21.

IMPROVING LOW LEVEL PERFORMANCE

All Martin-Baker seats are equipped with a barostat which serves the same purpose as the automatic actuator, thus eliminating the necessity of installing an automatic opening device inside the Martin-Baker personnel parachute.

The barostat is mounted on the right vertical main beam of the seat. It consists of a barostatic control which delays release action until the seat has reached 10,000 (+3,000, -0) feet; a g-controller which also delays release action until g forces acting upward and parallel to the seat main beams drop below 4 (+1/2, -1) g's, and a time release mechanism which releases the pilot from the seat and allows deployment of the personnel parachute. The time release mechanism is set to operate within 1.5 seconds after being set into motion by the barostat.

Removal and replacement of these assemblies are functions of the AME rating.

ANTI-SQUID LINES

Anti-squid lines are made of two lengths of type I rayon braided cord without core with a tensile strength of 400 pounds. They are installed to promote parachute opening at low speeds by preventing streamers, and thereby improve the system low altitude capability. They are designed to break at high speed and thus avoid inducing high parachute opening forces.

They are slightly shorter than the suspension lines and are attached to the personnel parachute between the peak of the canopy and the front pair of connector links. At the peak they are fastened to the bight of the withdrawal line with two turns and three half-hitches, then down through the center of the inside of the canopy and attached at the opposite end of the line to the connector link with the same two

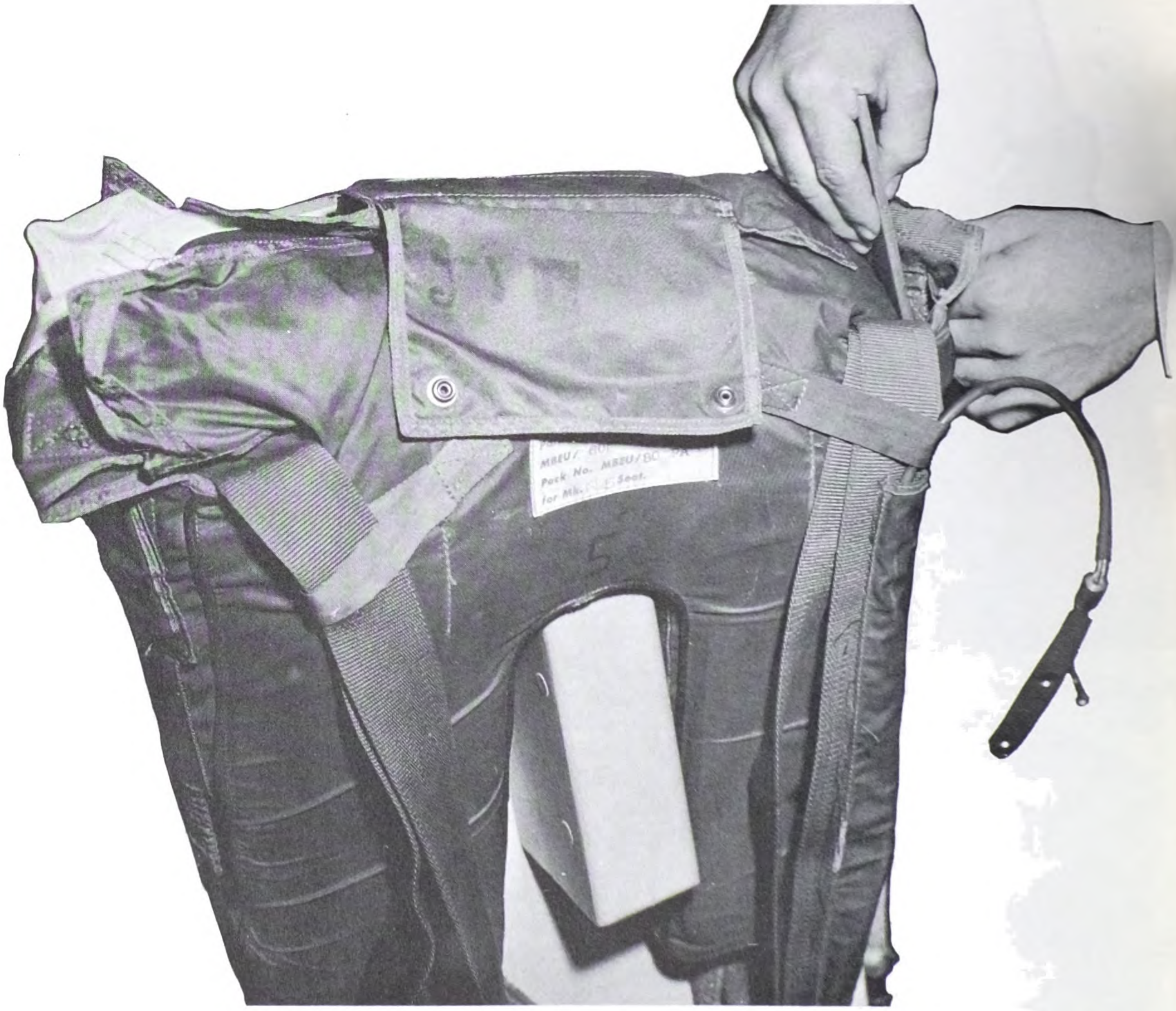
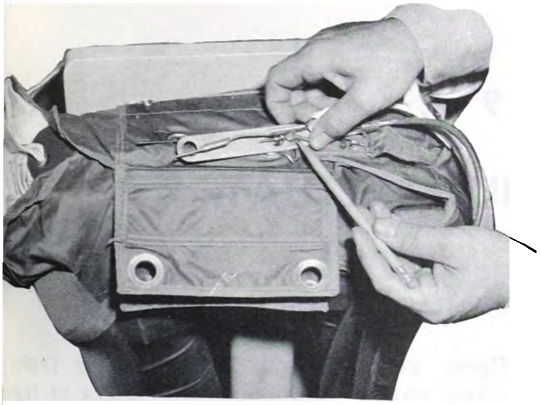


Figure 8-19.—Pack placed on stand for final closing.

turns and three half-hitches. The free ends of the line are then whipped to the standing part with pressure sensitive adhesive tape.

CAUTION: Make sure that the anti-squid lines do not foul the suspension lines.

More detailed instructions for the installati of these lines as well as other modificatio to improve low level performance of the Marti Baker parachute are found in ACSEB's 22- and 38-61A.



gure 8-20.—Insert rear ripcord pin through
e in end of ripcord cable and through
le in rear locking cone.

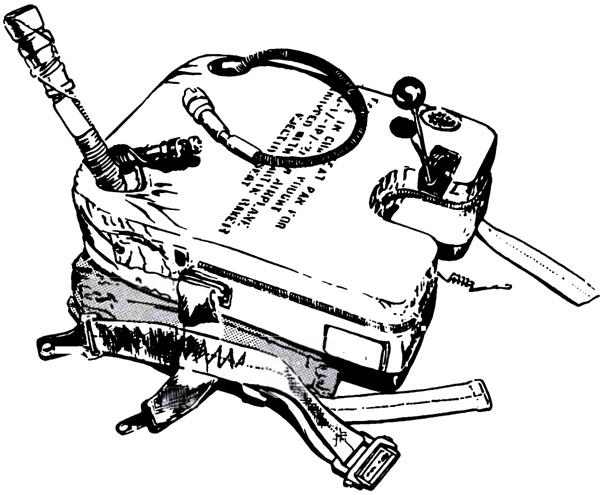


Figure 8-21.—Personal survival kit used in F-8 (F8U) series aircraft.

CHAPTER 9

AUTOMATIC PARACHUTE ACTUATOR

MASTER SPECIALTIES PARACHUTE ACTUATOR

The Master Specialties actuator is a pyrotechnic device, utilizing energy derived from an explosive cartridge to withdraw the ripcord from a packed parachute. Firing of the cartridge is controlled by an aneroid assembly which functions at a preset altitude (normally 10,000 feet) to release the firing mechanism. Figure 9-1 shows the Master Specialties actuator in the secured position, with the arming pin installed and the aneroid assembly securing the firing mechanism.

The actuator mechanism is enclosed in a protective tube which prevents damage to the parachute or the parachute pack when the device is installed or actuated.

When the arming cable is pulled above the preset altitude, the actuator is armed, but the aneroid sear prevents operation of the firing mechanism until the preset altitude is reached. Figure 9-2 (A) shows the arming pin removed, but the aneroid sear is securing the firing mechanism. Figure 9-2 (B) shows the firing mechanism completely released when the preset altitude has been reached.

When the arming cable is pulled below the preset altitude, immediate operation of the firing mechanism occurs.

Operation of the firing mechanism initiates action which results in the explosion of a main powder charge in the cartridge after a time interval of 2 or 3 seconds, depending on the designated cartridge used. This delayed explosion forces the piston and its attached power cable to move forward. The forward movement of the power cable (with the attached parachute ripcord) results in opening of the parachute pack and release of the parachute. Figure 9-3 shows the power cable at its extreme forward position.

PREPARATION FOR USE

Upon removal of the actuator from t
shipping carton, the exterior parts of the u
should be inspected for damage during shipp
and storage. An inspection should be made f
corrosion, dirt, dents, and cracks.

Loading

To load the actuator, proceed as follow

Remove the screw (3) and washer (4) fro
the cover assembly (fig. 9-4). Slide the receiv
assembly from the cover assembly and check t
position of the hammer assembly. If the hamm
assembly is not in the position shown in figu
9-5, completely separate the barrel assemb
from the receiver assembly and allow t
hammer assembly and lock to drop into t
armed and cocked position.

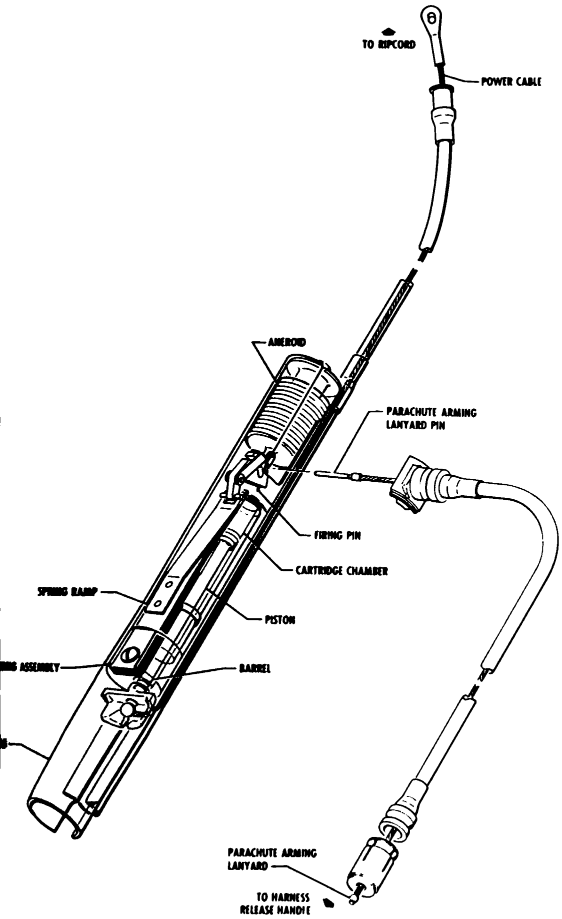
Insert the pin of the arming pin assemb
(24, fig. 9-4) through retainers (34). The p
must pass through the holes in the lock (2

With the hammer assembly secured in t
armed position, reassemble the barrel assemb
to the receiver assembly.

WARNING: Engage the forked end of t
longest spring of the barrel assembly with t
pin on the hammer assembly so that ha
pressure is needed to press the barrel in
the recess of the receiver assembly. If t
spring is inadvertently positioned under t
hammer assembly pin, the unit will not operat

Insert a cartridge in the barrel (fig. 9-
and press the barrel into the recess of t
receiver assembly. Slide the receiver assemb
into the cover assembly, exercising care t
the base of the housing assembly is prope
aligned with the barrel assembly and the cov
assembly. (See fig. 9-7.)

WARNING: Exercise extreme caution aft
the cartridge has been inserted in the barre
Do not allow either end of the cover assemb



igure 9-1.—Master Specialties actuator in the secured position.

e pointed towards the face as flame and smoke y result in impairment of vision in the event ccidental misfire.

Install the washer and screw in the cover embly.

allation

Connect the swaged fittings at the end of the er cable assembly to the parachute ripcord.

Attach the parachute actuator to the para-te pack in accordance with the instructions tained in the applicable Aviation Clothing and vival Equipment Bulletin.

intenance

Maintenance on the Master Specialties para-te actuator by operating activities is limited to the replacement of exploded or outdated cartridges, and to the visual inspection and replacement, when necessary, of Teflon seal and cartridge, after firing.

WARNING: Do not attempt to remove the aneroid assembly from the receiver nor attempt to make any adjustments to the aneroid assembly and the sear. The complete unit should be returned to the Supply Department when serviceability is questioned.

REPLACEMENT OF CARTRIDGE.—In the event that an exploded cartridge is stuck in the barrel, the following procedure should be followed:

Mount the barrel assembly in a vise with wooden blocks between the vise jaws and the barrel assembly. Insert the blade of a screwdriver between the barrel and cartridge rim so that the screwdriver is inclined approximately

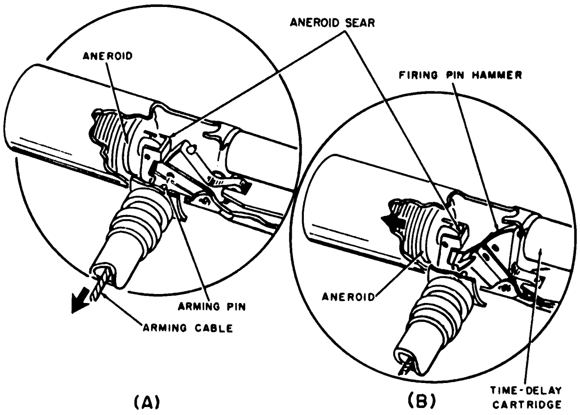


Figure 9-2.—Master Specialties actuator, (A) Arming pin removed; (B) firing mechanism released.

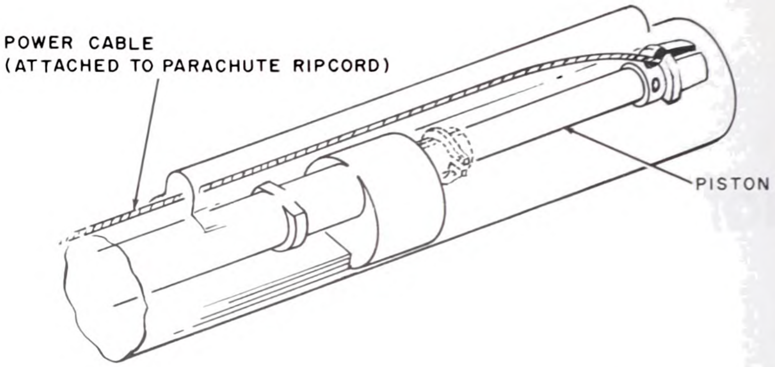


Figure 9-3.—Master Specialties actuator, power cable at extreme forward position.

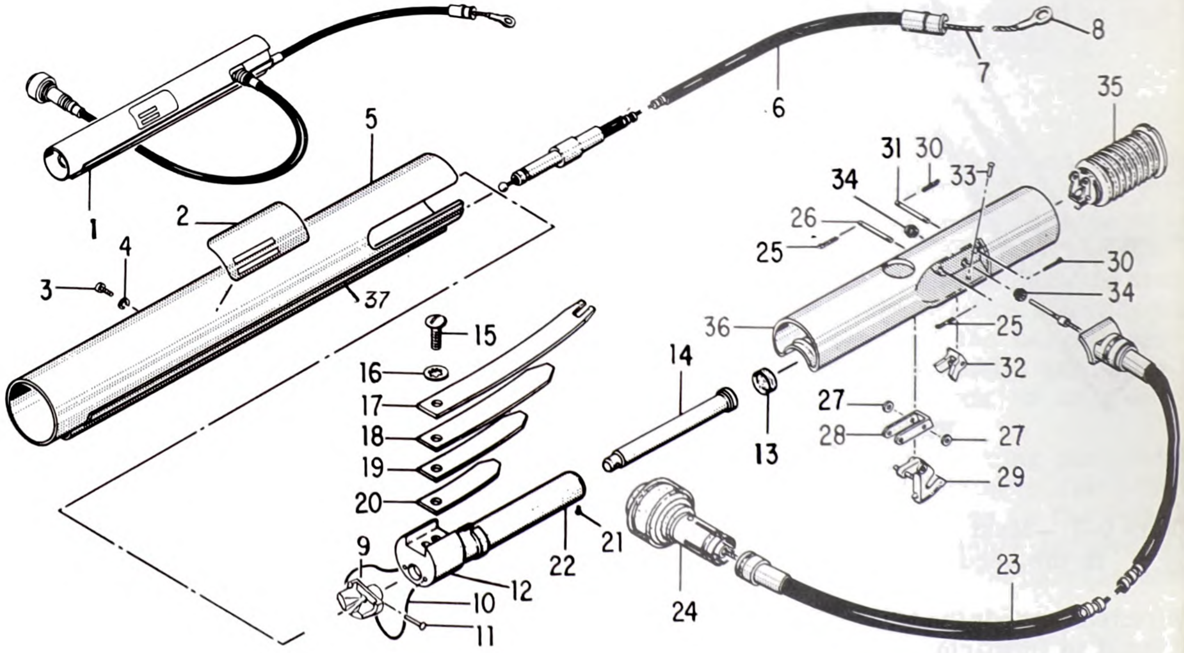
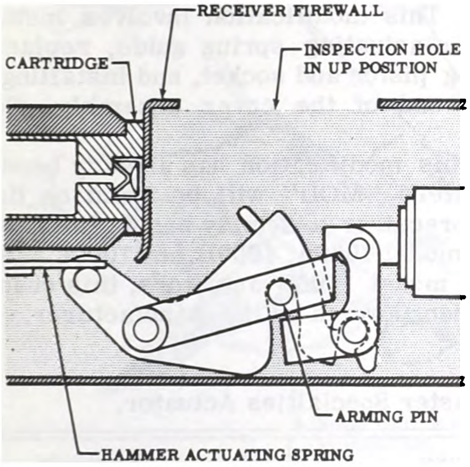
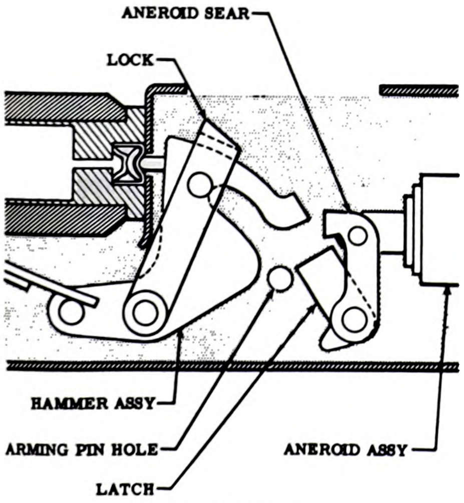


Figure 9-4.—Master Specialties parachute actuator.

1. Actuator assembly.
2. Nameplate.
3. Screw.
4. Washer.
5. Cover assembly.
6. Cable housing assembly.
7. Cable assembly.
8. Swaged fitting.
9. Socket.
10. Wire.
11. Rivet.
12. Spring retainer.
13. Teflon seal.
14. Piston.
15. Screw.
16. Washer.
17. Spring.
18. Spring.
19. Spring.
20. Spring.
21. Rivet.
22. Barrel.
23. Housing assembly.
24. Arming knob assembly.
25. Pin.
26. Pin.
27. Spacer.
28. Lock.
29. Hammer assembly.
30. Pin.
31. Pin.
32. Sear.
33. Rivet.
34. Retainer.
35. Aneroid assembly.
36. Receiver.
37. Cover assembly.



ARMED AND COCKED POSITION



FIRED POSITION

Figure 9-5.—Firing mechanism.

degrees toward the barrel assembly. Tap butt of the screwdriver lightly with a mallet move the screwdriver blade around the cart- ge rim between taps as the expended cart- ge is extracted.

The barrel must be cleaned and the seal laced after each firing of the cartridge. nove the rivet (11, fig. 9-4) and socket (12). nove piston (14) from the barrel and rivet embly. In the event that the Teflon seal ongealed, mount the barrel and rivet assem- in a vise with protective wooden blocks ween vise jaws and barrel. Use a rawhide mallet to carefully drive the shaft of the piston through the barrel and rivet assembly. Use a 1/4-inch punch to drive the piston out of the barrel and piston assembly.

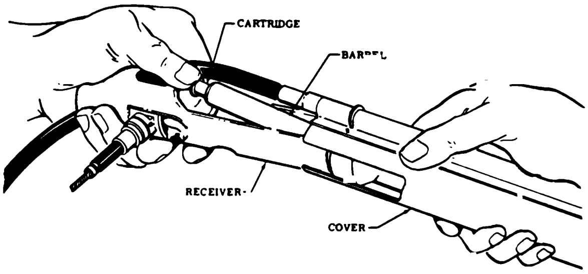


Figure 9-6.—Installing cartridge in barrel.

Carefully clean the piston face with a knife blade so that no plastic, powder, or dirt remain. If the periphery of the piston requires cleaning, use the same care in cleaning it.

Swab the bore of the barrel and rivet assembly with a stiff bristle brush which has been dipped in warm water, until no evidence of dirt is visible.

After the cleaning operation, check the vent for obstructions by closing the cartridge end of the barrel and rivet assembly and applying dry, filtered air at approximately 50 psi to the base end of the barrel and rivet assembly. If the vent is clogged and air does not flow through the hole between the piston and springs, it will be necessary to remove the screw (15, fig. 9-4), washer (16), and springs (17, 18, 19, and 20). After removal of the springs, ream the vent through both vertical and horizontal passages, using a 0.093-inch diameter reamer or a No. 42 drill.

CAUTION: Do not ream or drill the threaded hole for the spring retaining screw. Remove all chips and dirt from the vent after reaming.

Reassemble the unit, observing all previously mentioned safety precautions. Lockwire the piston assembly to the barrel assembly before final assembly with 0.032 soft copper wire (no substitute).

INSPECTION.—The actuator must be given a physical inspection prior to each flight as follows:

Inspect the cover assembly for dents, foreign matter, and corrosion.

Inspect the swaged fitting at the end of the power cable for security and tightness. Inspect the cable for broken wires and corrosion.

Inspect cable housing assemblies for cracks, defects, and for dents or other damage which might impair operation of the unit.

TROUBLESHOOTING.—Table 9-1 lists the most common troubles, along with the probable causes and remedies.

MODIFICATIONS.—All Master Specialties actuators in the 1000A, 1000B, and 1000C series must be modified in accordance with Aviati Clothing and Survival Equipment Bulletin 14-60. This modification involves installing hammer-actuating spring guide, replacing existing piston and socket, and installing a pl in the end of the cover assembly. (See fi 9-8.)

If this modification has already been mad the letters "MOD" will be found on the re of the receiver assembly beside the namepla on all model 1000A, 1000B, and 1000C actuator On all model 1000D actuators, this change been incorporated by the manufacturer.

Table 9-1.—Troubleshooting Chart For Master Specialties Actuator.

Trouble	Probable Cause	Remedy
Sear engages lock at altitude less than 10,000 feet.	Aneroid assembly leaks.	Return to Supply.
	Aneroid assembly bent.	Return to Supply.
	Receiver housing bent.	Return to Supply.
Power cable or arming pin cable stuck in housing assembly.	Housing assembly damaged.	Return to Supply.
	Cable assembly defective.	Return to Supply.
Cartridge will not fit in barrel.	Wrong size cartridge.	Use recommended cartridge.
	Obstruction in barrel.	Remove obstruction, clea barrel.
Barrel assembly cannot be seated in receiver assembly.	Hammer assembly has not been pinned in armed position and allows firing pin to restrict seating of parts.	Insert arming pin throug lock.
Receiver assembly will not fit in cover assembly.	Cover assembly dented or damaged.	Return unit to Supply.

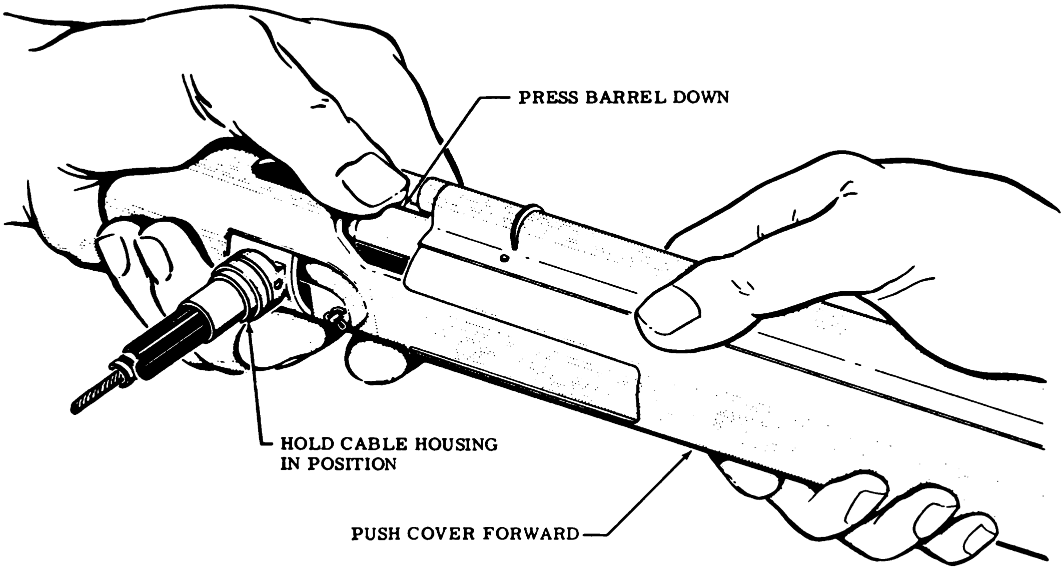


Figure 9-7.—Final assembly procedure.

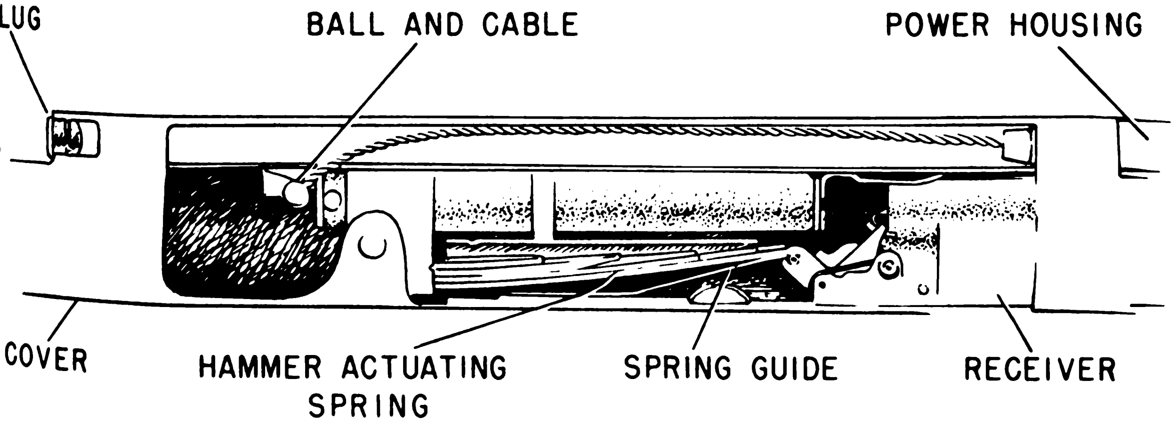


Figure 9-8.—Modified actuator, Master Specialties 1000D.

CHAPTER 10

SEWING MACHINE OPERATION AND LUBRICATION

The nature of the Parachute Rigger's work in the maintenance and upkeep of aviator's equipment requires that he have a thorough knowledge of the minor adjustments to be made, and the proper lubrication of standard sewing machines. He must also be a skilled operator of these machines in order to keep flight clothing and survival equipment in good repair.

This chapter gives a background for obtaining this knowledge, but the actual skill in operating machines can be acquired only by practice at sewing on scraps of material or on jobs which may not require a lot of skill such as manufacture of pitot covers, small flags or pennants, etc. It behooves the PR striker to use as much of the time spent in the loft as is possible in practice sewing.

SEWING MACHINE FAMILIARIZATION

Sewing machines are divided into two types, OSCILLATING and ROTARY. Both types are operated by electric motors and are fitted with rheostats and special clutch arrangements which enable the operator to control the speed.

Oscillating type sewing machines are named for the action of the sewing hook, which rocks back and forth through half of one revolution to complete one stitch.

Rotary type sewing machines are also named for the action of the sewing hook, which makes two complete revolutions to complete one stitch.

The type of stitch commonly used and made by sewing machines in repair work is the lockstitch. The lockstitch makes use of two separate threads. One comes from the spool down through the eye of the needle, the other from the bobbin. In making the lockstitch, these two threads must become interlocked, as shown in figure 10-1.

The thread passing through the eye of the needle is pushed down through the material being sewn. As the needle travels through
material, a thread controller spring pulls
the needle thread to prevent any slack that mi
tangle the thread around the needle.

After the needle reaches its lowest posit
and starts its upward movement, a small l
of thread forms alongside the needle beneath
throat plate. The sewing hook catches this l
and carries it around the bobbin, which flo
in its track in the bobbin case. By locking
loop of needle thread around the bobbin thre
the sewing hook forms the stitch.

As the needle completes its upward mo
ment, the thread tension discs hold the nee
thread firmly, and the thread takeup lev
rising quickly, pulls on the loop that has b
formed and thus tightens the stitch. When
thread takeup lever reaches its highest positi
the stitch is completed.

The standard sewing machine has five ba
parts: bed, uprise, arm, face, and balance whe
The BED houses the linkage from the h
driving shaft pulley to the sewing hook assemb
the UPRISE houses the arm shaft connection be
the BALANCE WHEEL is connected to the a
shaft in the ARM which operates the needle
mechanism in the FACE of the machine.

The machine is powered by an electric m
tor, which is connected to the motor driv
pulley by a clutch. The motor is connected
the clutch by pressing the forward part of
foot treadle. The aft part of the treadle is
brake which acts upon the clutch.

The material to be sewn is held in posit
on the feed dog by the presser foot. The pre
sure of the presser foot upon the mater
enables the feed dog to push the material fo
ward each time the needle goes up. The pre
sure of the presser foot on the material
released either by a knee lifter or a hand lift
The presser foot can be raised by pushing
knee lifter to the right. The hand lifter is
cated behind the face of the machine. T

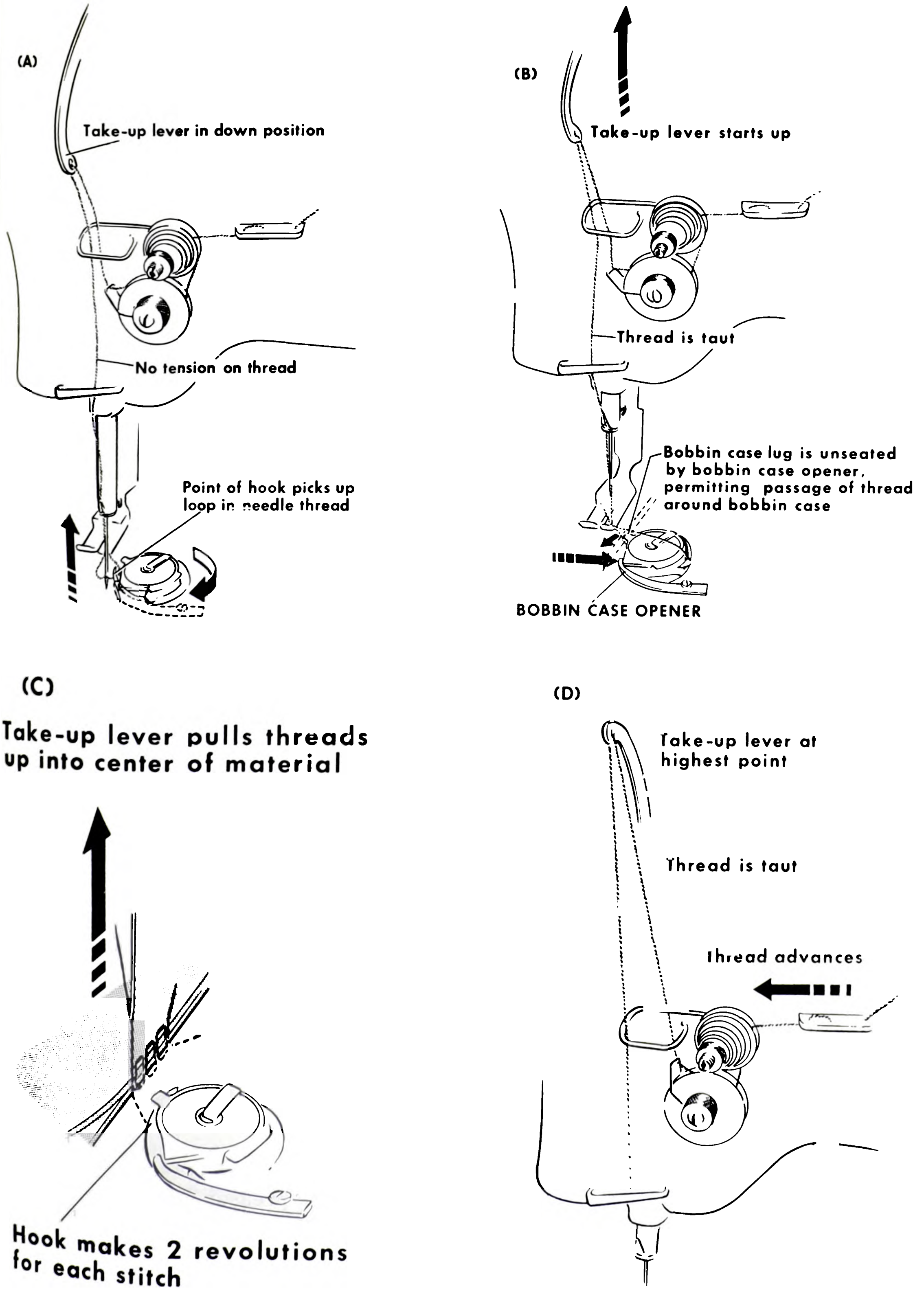

(A)
Take-up lever in down position
No tension on thread
Point of hook picks up loop in needle thread
(B)
Take-up lever starts up
Thread is taut
Bobbin case lug is unseated by bobbin case opener, permitting passage of thread around bobbin case
BOBBIN CASE OPENER
(C)
Take-up lever pulls threads up into center of material
Hook makes 2 revolutions for each stitch
(D)
Take-up lever at highest point
Thread is taut
Thread advances

Figure 10-1.—The lockstitch.

presser foot may be lifted and locked into position by raising the hand lifter to its highest position.

OSCILLATING TYPE SEWING MACHINES

Two of the most commonly used oscillating type sewing machines are the 31-15 and the 7-33, both of which are discussed in this chapter.

SINGER SEWING MACHINE 31-15

The 31-15 is an oscillating type sewing machine which has a recommended speed of 2,200 stitches per minute and makes a lockstitch. The 31-15 is intended for sewing clothing. It is very good for nylon cloth sewing and can be used for sewing lightweight canvas up to 8 ounces. The number of stitches can be regulated from 7 to 32 stitches per inch.

When the 31-15 machine is in operation, the balance wheel turns over toward the operator. When hand-turning the balance wheel, always rotate it in this direction.

The components of the Singer Sewing Machine 31-15 are shown in figure 10-2.

Lubrication

To insure easy operation and to prevent unnecessary wear of the moving parts, all sewing machines need oiling. When a machine is in constant use, it should be oiled twice a day. A new machine should be oiled more frequently when in constant use. A castor base oil is recommended since mineral base oil tends to gum the moving parts.

Oiling points for the 31-15 machine are shown in figures 10-3, 10-4, and 10-5.

Oil should be applied regularly to the shuttle bearing in the shuttle race. Occasionally remove the faceplate and apply oil to the bearings and joints that are uncovered.

Needles and Thread

The proper needle to be used on the 31-15 Singer Sewing Machine is class and variety 16 x 87. Needles are available in various sizes and any of the following sizes may be used: 14, 16, 17, 18, 19, 21, 22, and 23. The size of thread used determines the size of needle to be used. Needles vary in size according to number: the smaller the number, the smaller the needle diameter; the larger the number, the larger the needle diameter. Needles do not vary in leng within the same class and variety.

Orders for needles must specify the QUA TITY required, the SIZE number, and the CLA and VARIETY number, separated by an "X

An example of an order follows:

100 No. 18, 16 x 87 needles.

Best results will be obtained in using needl furnished by the manufacturer of the machin

Figure 10-6 shows the six parts of a need used in an oscillating type sewing machine.

The thread to be used on an oscillating ty sewing machine is LEFT TWIST (also known Z twist). Either right or left twist thread can used in the bobbin, but to eliminate the po sibility of mixing the machine and bobbin threa it is advisable to order only left twist threa

To determine the twist of thread, hold t thread as shown in figure 10-7. Turn the thre toward you with the right hand; if it is le twist, the strands will wind tighter; if it right twist, the strands will unwind.

To determine the relative sizes of needle and threads that can be used, refer to table 10-

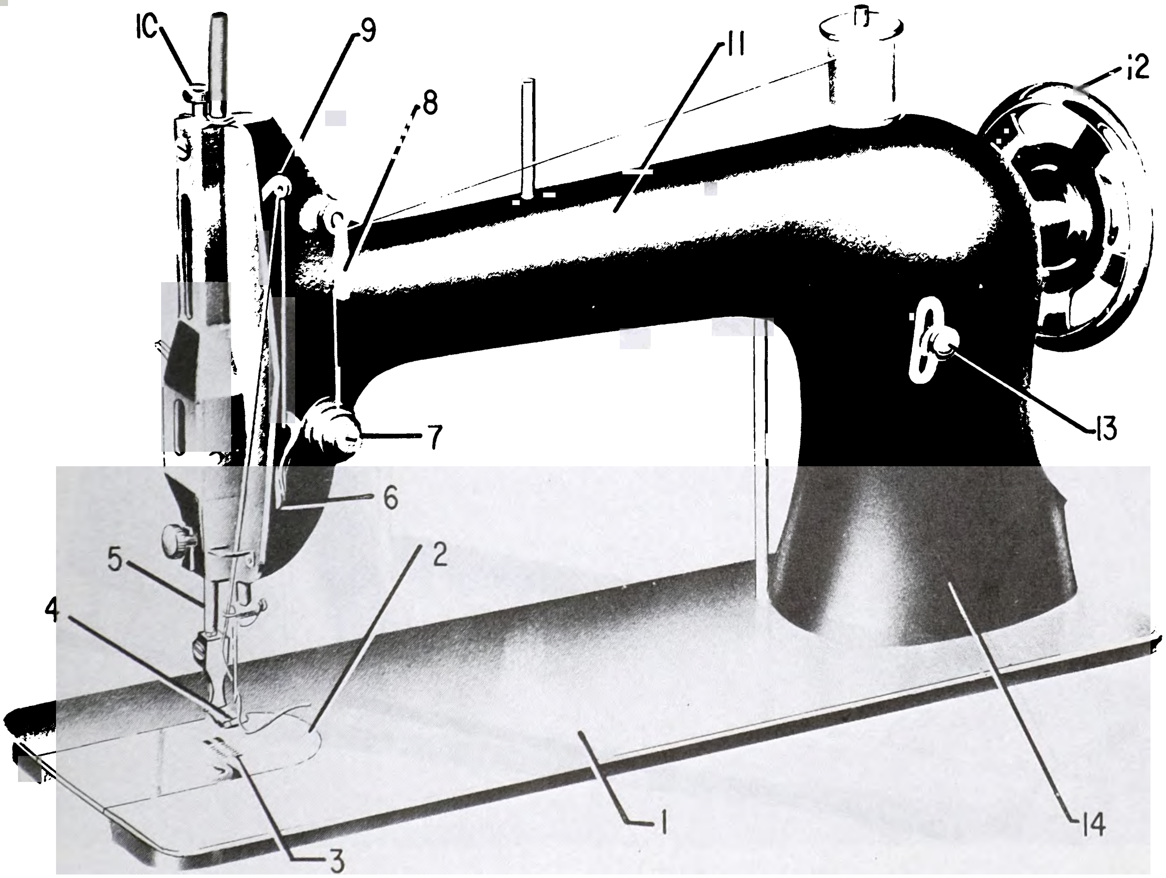
Table 10-1.—Relative sizes of needles and thread.

Sizes of needles	Cotton thread size	Nylon thread size
18	24 x 4	A and B.
19	24 x 4	C.
21	24 x 4	E.
22	16 x 4	E.

Operation

The following practices and procedures w help to insure safe and smooth operation of t sewing machine:

1. The balance wheel must always turn t ward the operator.
2. Do not run the machine with the press foot resting on the feed dog without materi being under the presser foot.
3. Do not run the machine when both bobb case and needle are threaded unless there material under the presser foot.
4. Do not try to help the machine by pulli the material. You may bend or break the needl



1. Bed.
2. Throat plate.
3. Feed dog.
4. Presser foot.
5. Needle bar.
6. Face.
7. Tension regulating thumb nut.
8. Thread retainer.
9. Thread takeup lever.
10. Pressure regulating thumbscrew.
11. Arm.
12. Balance wheel.
13. Feed regulator thumbscrew.
14. Upright.

Figure 10-2.—Singer Sewing Machine 31-15.

properly adjusted, the machine feeds the work thout assistance.

5. The slide over the bobbin case should be pt closed when the machine is in operation.

6. Keep your head away from the takeup ver.

7. When running the macine do not take your es away from the needle and presser foot.

8. Keep your fingers from under the needle.

tting the Needle

Turn the balance wheel toward you until the read takeup lever moves upward to its highest point; loosen the setscrew in the needle clamp; insert the needle ALL THE WAY into the needle bar so that the long groove of the needle is toward the left, and the eye of the needle is directly in line with the arm of the machine; then retighten the setscrew. NOTE: When setting any needle, always insert it with the long thread groove toward the bobbin.

Threading the Machine

Threading a sewing machine is a very simple job. The procedure may vary slightly with different models; but after working with the various

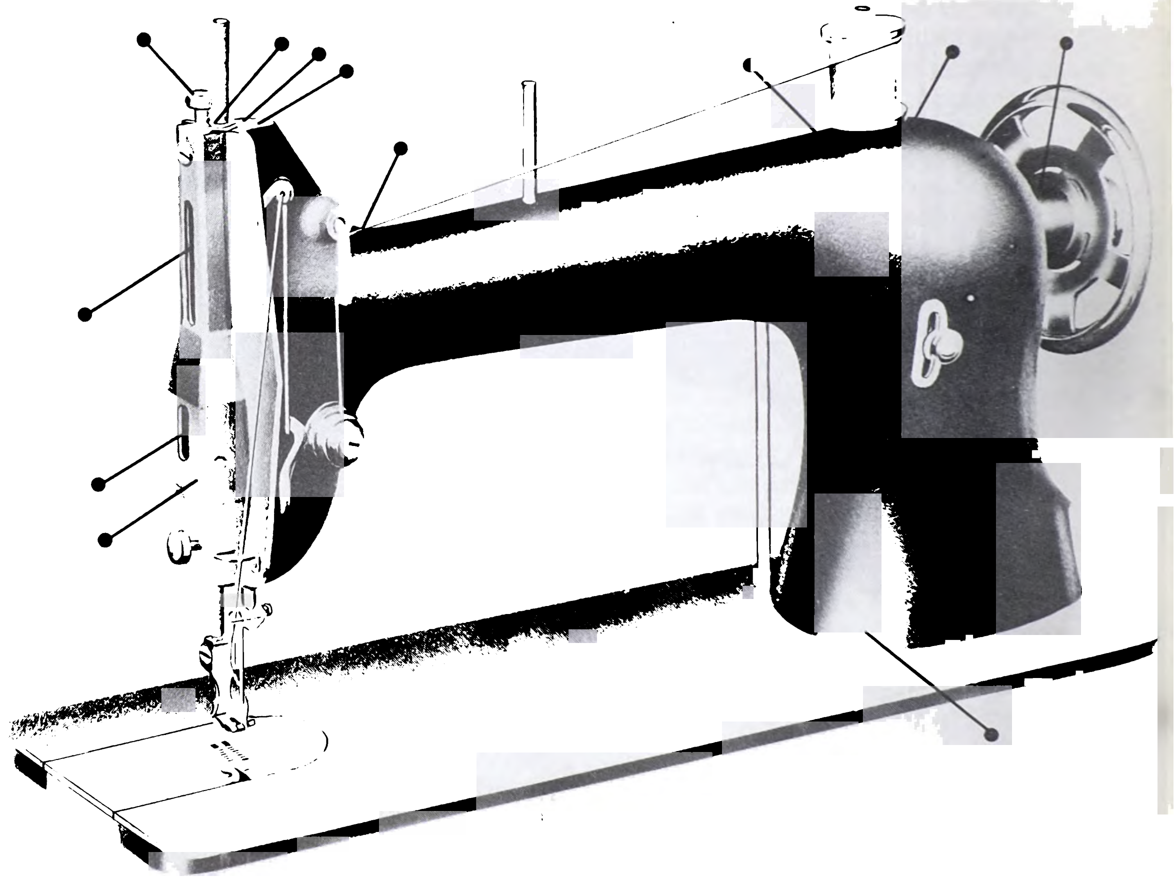


Figure 10 3. Oiling points at the front of the machine.

machines in the loft, the task will become automatic.

The procedure for threading the 31-15 sewing machine is illustrated in figure 10-8 and described in the following paragraph.

Pass the thread from the thread stand to the thread post on top of the machine, right to left through the bottom hole, and then right to left through the top hole. Pass the thread from right to left through the top hole in the thread retainer (1). Pass the thread from left to right through the middle hole in the thread retainer (2). Pass the thread from right to left through the bottom hole in the thread retainer (3). The thread is then passed down and under from right to left between the tension discs (4). Draw the thread up into the thread takeup spring (5), drawing the thread up and beyond the spring end so that it comes out in the center of the spring. The thread is then placed under the tension thread guard (6). Pass the thread up and from right to left through the hole in the thread tak
lever (7). The thread is now drawn down thro
three thread guides (8), (9), and (10). Pass
thread from left to right through the eye of
needle (11). Draw about 2 inches of thr
through the eye of the needle with which
commence sewing.

Removing the Bobbin Case

Before attempting to remove the bobbin ca
turn the balance wheel toward you until
needle moves upward to its highest position.

Remove the slide in the bed of the mach
for visibility, reach under the table with the
hand, and using the thumb and forefinger, o
the bobbin case latch (1, fig. 10-9), and lift
the bobbin case (2).

While the latch is held open, the bobbi
retained in the bobbin case. Release the lat
turn the open end of the bobbin case down,
the bobbin will drop out.

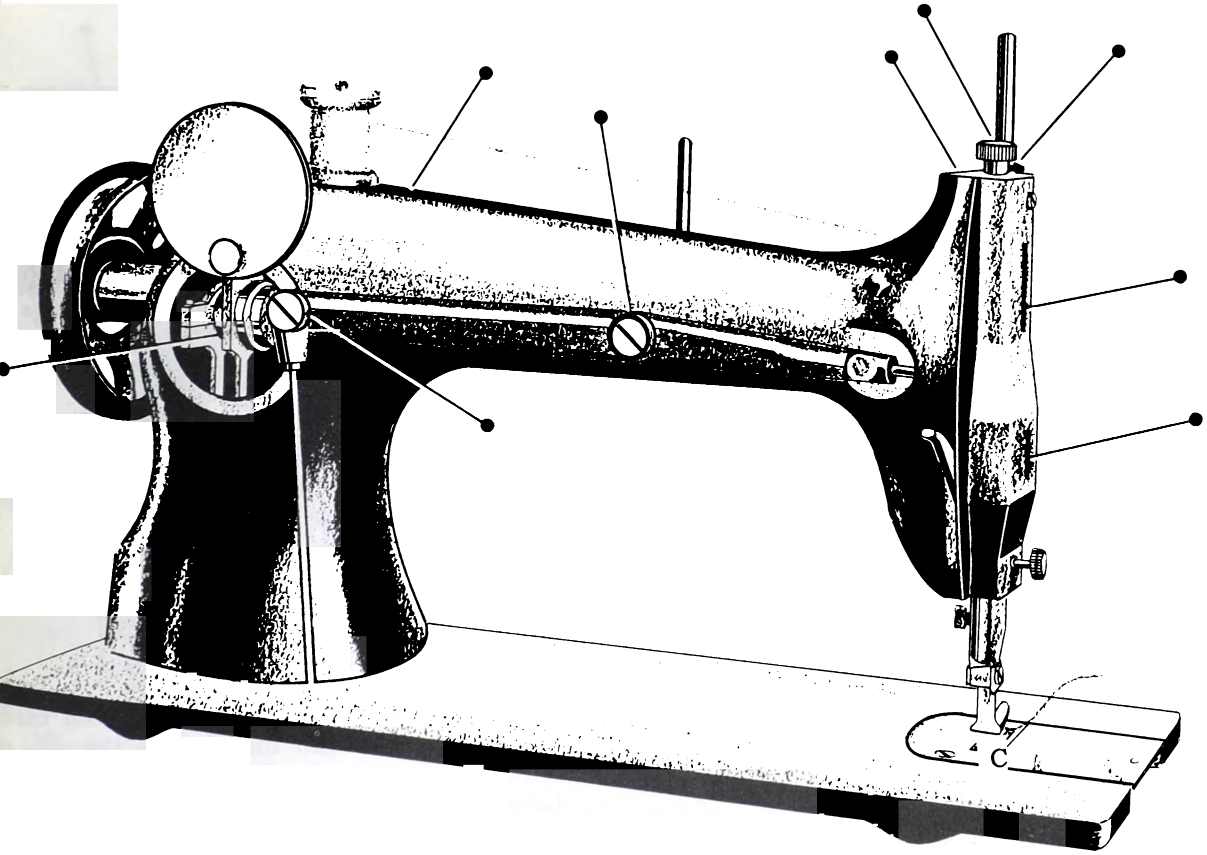


Figure 10-4.—Oiling points at the back of the machine.

ding the Bobbin

The bobbin winder is fastened to the table h its driving pulley in front of the sewing chine belt. The bobbin winder is so positioned allow the pulley to drop away from the belt en sufficient thread has been wound on the bin.

Figure 10-10 illustrates the bobbin-winding ration. The procedure is as follows: Place bobbin on the bobbin winder and push it on the ft as far as it will go. Pass the thread from spool down through the thread guide (1). Loop thread around back and through the tension cs (2). The thread is then wound around the bin a few times and the pulley pushed up inst the machine belt. The bobbin can be und while the machine is being used for ving. If there is no material under the esser foot, make certain that the presser foot is raised and not riding on the feed dog while winding the bobbin.

When sufficient thread has been wound on the bobbin, the pulley on the bobbin winder will drop back from the machine belt automatically. If the thread does not wind evenly on the bobbin, loosen the screw (3) in the tension bracket and move the bracket to the right or left as required; then tighten the screw. The amount of thread wound on the bobbin is regulated by the screw (4). To wind more thread on the bobbin, turn the screw to the right; to wind less thread on the bobbin, turn this screw to the left.

Threading the Bobbin Case

Hold the fully wound bobbin between the thumb and forefinger of the right hand with the thread end running over the top toward the right, as shown in figure 10-11 (A). With the left hand hold the bobbin case as shown, with the thread slot near the top.

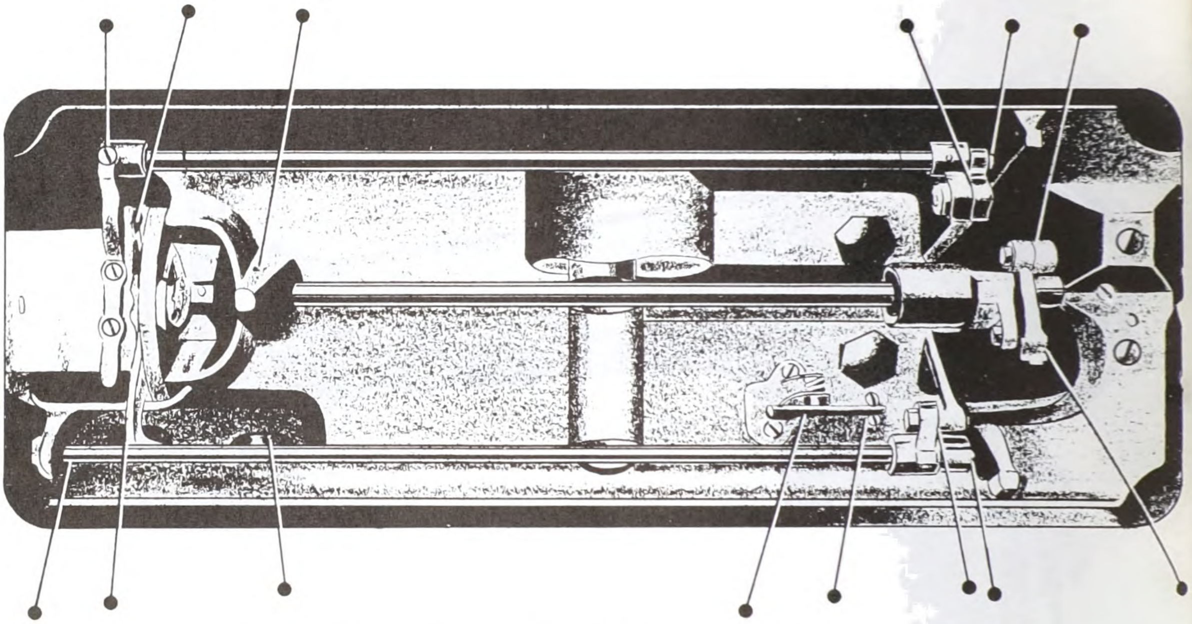


Figure 10-5.—Oiling points at the base of the machine.

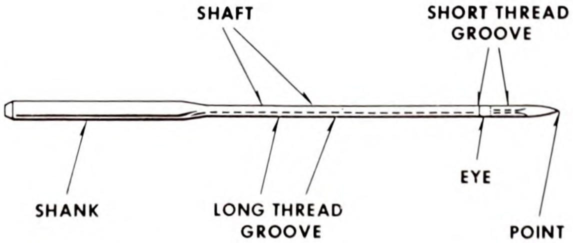


Figure 10-6.—Sewing machine needle adaptable to the 31-15 sewing machine.

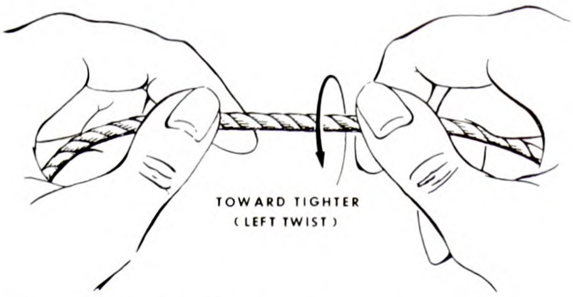


Figure 10-7.—How to determine the twist of thread.

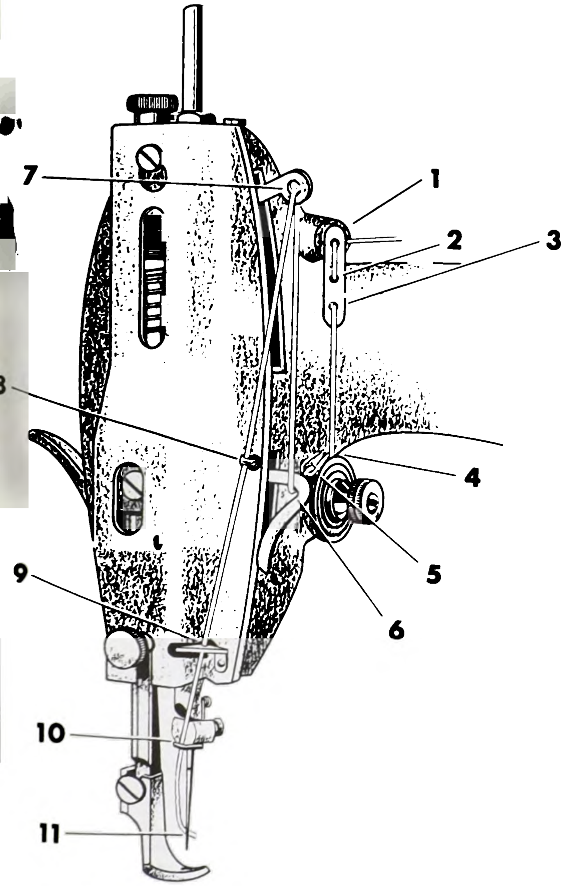
Place the bobbin into the bobbin case pull the thread into the slot in the edge of bobbin case (B). Draw the thread down under tension spring and into the delivery eye at end of the tension spring (C). When the free of the thread is pulled, the bobbin will rot clockwise if the bobbin case has been threa properly.

Replacing the Bobbin Case

Hold the latch open on the threaded bob case with the thumb and forefinger of the hand, with the latch in a horizontal positi Place the bobbin case on the center stud of shuttle body. Release the latch and press bobbin case back until the latch catches groove near the end of the stud.

Preparing for Sewing

With the left hand, hold the end of the nee thread, leaving it slack from the hand to needle. Turn the balance wheel toward until the needle moves down and catches bobbin thread. Continue to turn the bala wheel forward until the needle comes up brings the bobbin thread up with the nee thread.



1. Top hole of thread retainer.
2. Middle hole of thread retainer.
3. Bottom hole of thread retainer.
4. Tension discs.
5. Thread takeup spring.
6. Tension thread guard.
7. Thread takeup lever.
8. Thread guide.
9. Thread guide.
10. Thread guide.
11. Needle eye.

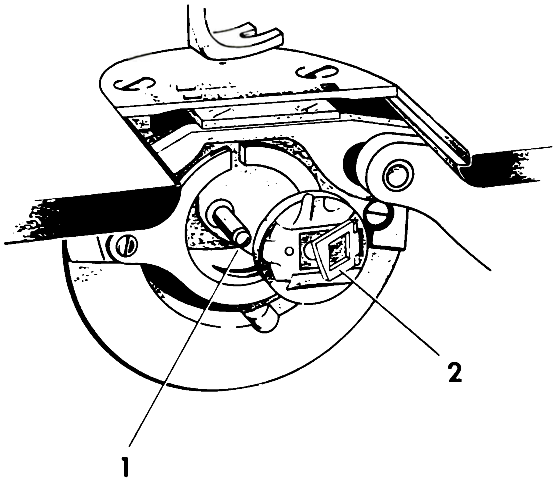
Figure 10-8.—Threading the 31-15 sewing machine.

With the thread takeup lever at its highest ition, lay both threads back under the presser t.

nmencing to Sew

Place the edge of the material beneath the sser foot, lower the presser foot, turn the balance wheel by hand until the needle is in the material, and press lightly on the treadle. To prevent fouling the needle thread in the bobbin case, hold the ends of both threads until the first few stitches are made.

While sewing, hold the work flat, but do not pull or push on the material. Let the feed dog carry the work evenly under the presser foot and needle. If the operator pulls on the material, the needle bends, strikes the throat plate, and is either dulled, or more likely, broken. When the needle is about to cross a seam or other unusually thick or uneven place in the work, disengage the clutch, and hand-turn the machine over the rough place; otherwise, the needle may be broken or thrown out of time.



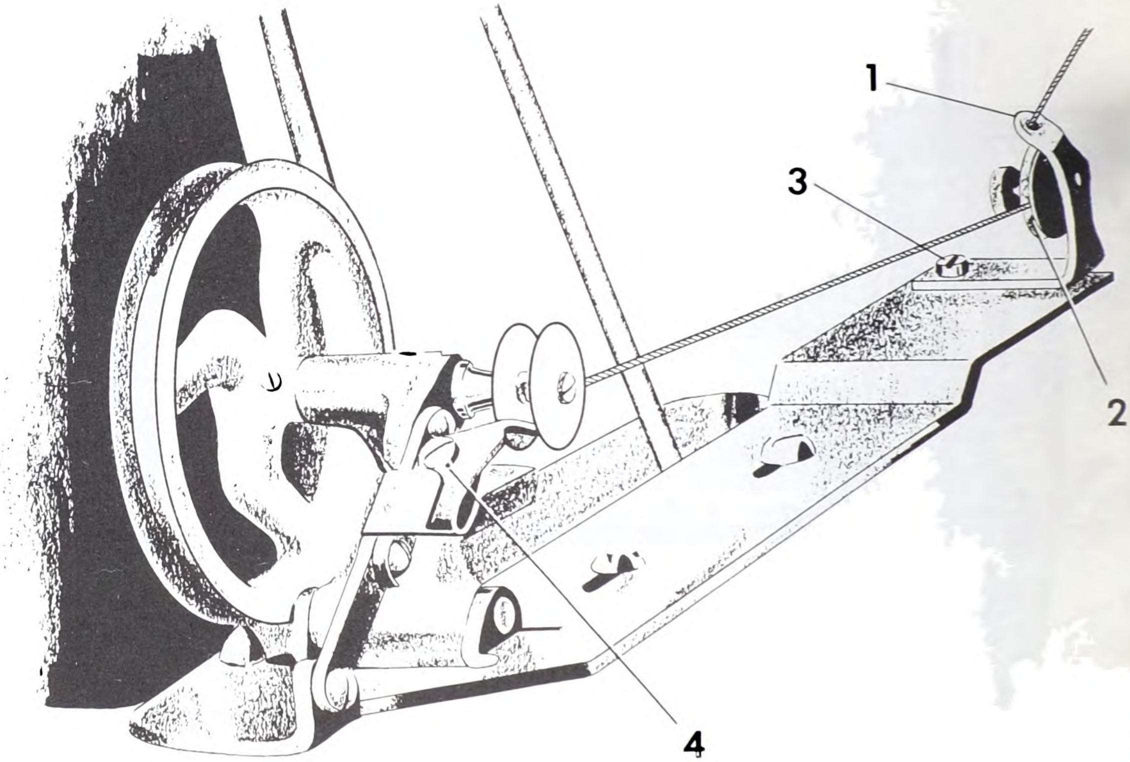
1. Bobbin case latch.
2. Bobbin case.

Figure 10-9.—Removing the bobbin case.

Regulating the Tension

The tension on the needle thread should be regulated only when the presser foot is down. If the tension of the machine thread is not correct, it should be adjusted by turning the tension adjusting nut, as shown in figure 10-12. To INCREASE THE TENSION, turn the nut clockwise, to DECREASE THE TENSION, turn the nut counterclockwise.

The tension on the bobbin thread is regulated by the small screw in the bobbin case tension



1. Thread guide.
2. Tension disc.
3. Setscrew.
4. Setscrew.

Figure 10-10.—Winding the bobbin.

spring. To increase the tension turn the screw clockwise; to decrease the tension turn the screw counterclockwise.

This screw is very small and is easily lost if extreme care is not exercised in backing it out when decreasing the tension. If the screw is tightened excessively or is slightly too long, it will penetrate into the inside of the bobbin case and prevent removal of the bobbin.

When the tension on the bobbin thread has once been properly adjusted for a particular size of thread, it is seldom necessary to change it. A correct stitch can usually be obtained by varying the tension on the needle thread, which is an easier adjustment.

For ordinary stitching, the needle and bobbin threads should be locked in the center of the thickness of the material as shown in figure 10-13 (A). When adjusting the tensions, you will not have a cross section of the stitch.

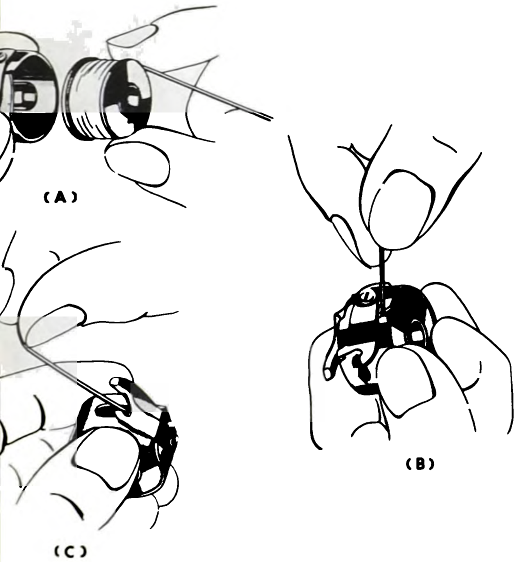
If the tension on the needle thread is too tight, or if the bobbin tension is too loose, the thread will lie straight along the upper surfa of the material and appear as small loops (f 10-13 (B)).

If the tension on the bobbin thread is t tight, or if that on the needle thread is too loo the bobbin thread will lie straight along t underside of the material (fig. 10-13 (C)).

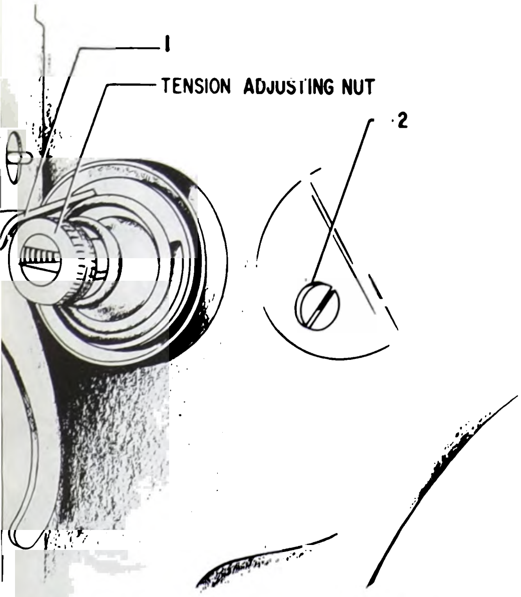
Regulating the Length of Stitch

The length of stitch can be checked at t time the tension of the stitch is checked, a trial run of stitches is necessary during b procedures.

The length of stitch is regulated by t thumbscrew in the slot on the front of the uprig of the machine. To LENGTHEN the stit loosen the thumbscrew and move the le DOWN. To SHORTEN the stitch, loosen t thumbscrew and move the lever UP. When t desired length of stitch has been obtained by te running the machine on scrap material, tight the thumbscrew.



ure 10-11.—Threading the bobbin case.



Thread takeup spring.   2. Setscrew

Figure 10-12.—Adjusting the machine thread tension.

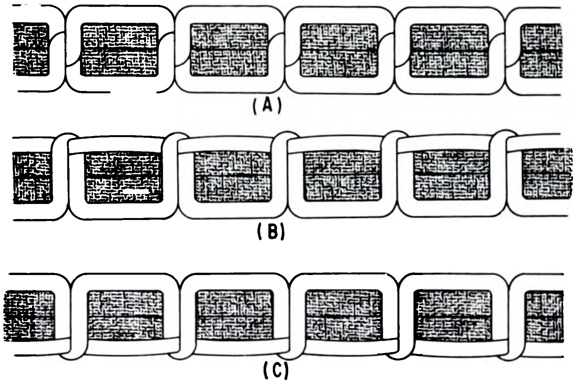


Figure 10-13.—Properly and improperly adjusted tensions.

Regulating the Pressure on the Material

Pressure on the material is regulated by the pressure regulating thumbscrew on top of the machine face. To increase the pressure, turn the thumbscrew clockwise. The pressure should be just heavy enough to enable the feed dog to move the work along evenly.

Removing the work

Hand-turn the balance wheel toward you until the thread takeup lever is at its highest position. Raise the presser foot, either by the hand lever or by the knee lift, and draw the work and threads straight behind the presser foot. Cut the threads close to the material, leaving about 2 free inches of bobbin and machine thread.

Adjusting the Thread Takeup Spring

The thread takeup spring (fig. 10-12) should be set so that when the eye of the needle reaches the material on the downward stroke of the needle bar, the spring will be through acting on the thread, and will rest against the stop of the thread takeup spring regulator.

If the thread takeup spring is not correctly set, loosen the setscrew (2) in the arm of the machine and turn the tension adjusting stud to the right for more movement of the spring, or to the left for less movement. When the spring is correctly set, retighten the setscrew.

The tension on the thread takeup spring should be just sufficient to take up the slack of the needle thread until the eye of the needle reaches the material on its descent. To increase the tension on the thread takeup spring, loosen the tension adjusting stud and move the takeup spring from the recess in the regulator to the right between the regulator and the tension discs. When the required tension is obtained, securely tighten the tension adjusting stud and move the spring back into its position in the regulator recess. To decrease the tension, move the spring to the left between the regulator and the tension discs.

SINGER SEWING MACHINE 7-33

The class 7-33 sewing machine is a lockstitch heavy duty machine and is intended for use in sewing heavy canvas, webbings, and other material not adaptable to the lighter duty sewing machines. The only difference between the 7-31 and the 7-33 is that the 7-33 has the clutch on the motor, while the 7-31 has the clutch the balance wheel. The operation and mai tenance techniques are identical.

As on any Singer Sewing Machine, the balan wheel of the 7-33 should always turn towa the operator.

Lubrication

The 7-33 machine is oiled at all the oili points shown in figures 10-14 and 10-15. T machine should be oiled twice daily when it is constant use. Use a castor base oil as recor mended by the manufacturer.

Needles and Thread

The procedure for ordering needles is t same for the 7-33 machine as for the 31- sewing machine. Refer to table 10-2 for t relative sizes of needles and thread.

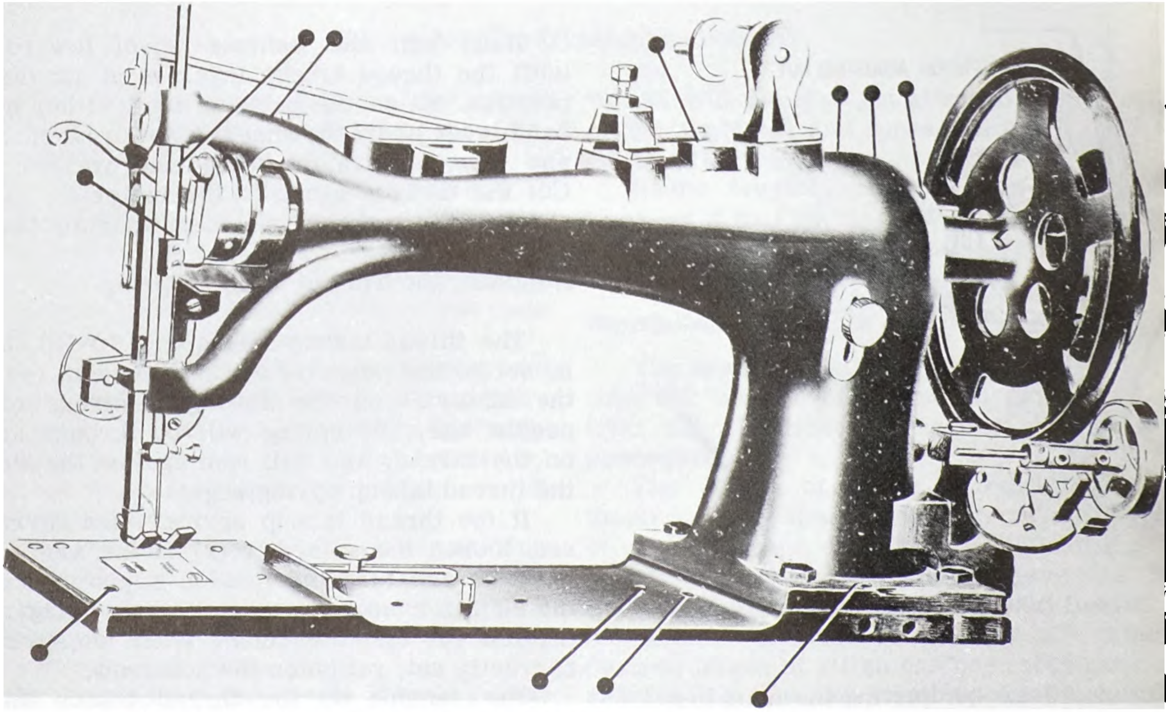


Figure 10-14.—Oiling points at the front of the 7-33 sewing machine.

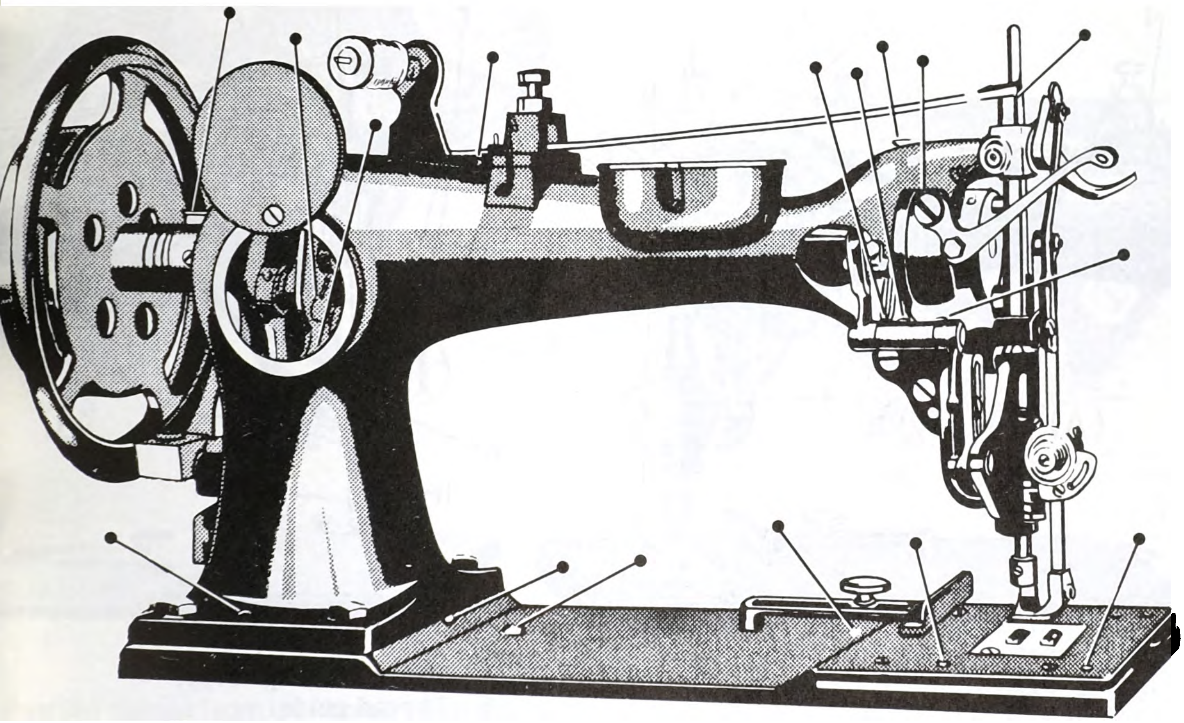


Figure 10-15.—Oiling points at the back of the 7-33 sewing machine.

Table 10-2.—Relative sizes of needles and thread.

achine	Needle class and variety	Needle sizes	Classes of work	Needle size	Cord size
1 or 7-33	7 x 1	19, 21, 22, 23, 24 25, 26, and 27.	Medium to heavy canvas.	24	3-cord
1 or 7-33	7 x 5	28, 29, 30, and 31.	Heavy canvas and webbing.	28	6-cord

eration

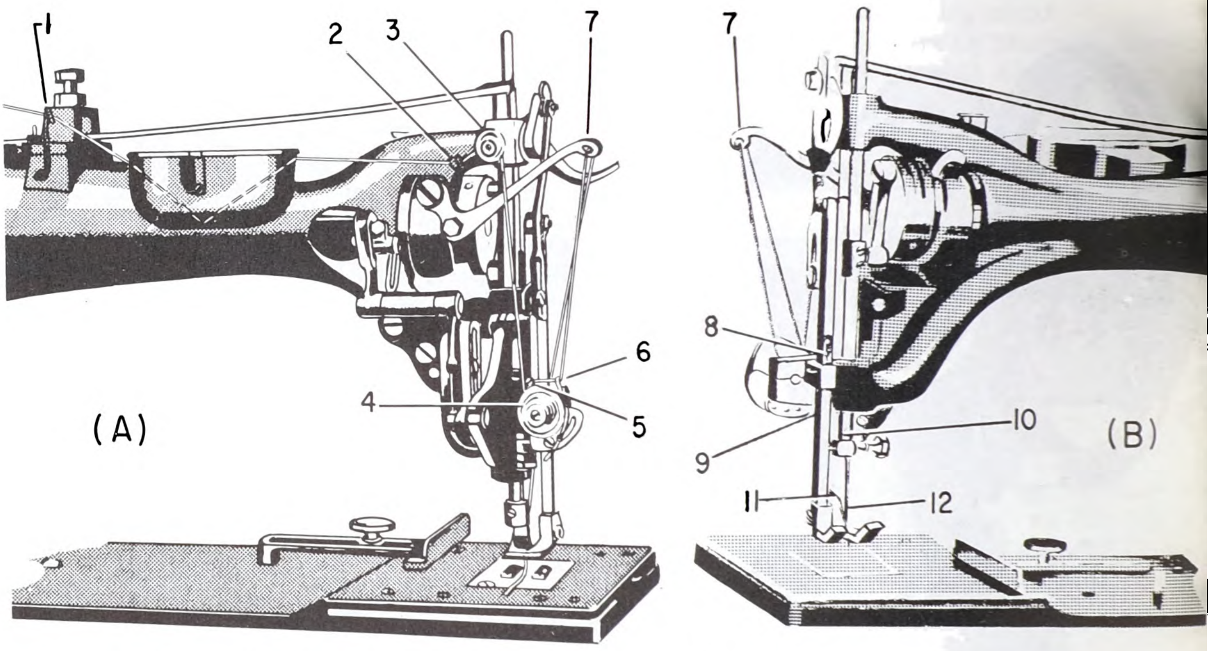
The procedure for operating the 7-33 sewing chine is the same as for the 31-15 sewing chine.

ting the Needle

The same procedure may be followed with machine as for the 31-15 sewing machine.

Threading the Machine

Turn the balance wheel toward you until the thread takeup lever (7, fig. 10-16) moves up to its highest position. Pass the thread from the thread stand to the thread post, right to left through the bottom hole then right to left through the top hole. Pass the thread through the two thread guides (1) and (2). Continue the passage of thread between the retainer discs



1. Thread guide.
2. Thread guide.
3. Retainer discs.
4. Tension discs.
5. Thread takeup spring.
6. Wire loop.
7. Thread takeup lever.
8. Thread guide.
9. Slot in the vibrating presser bar.
10. Thread guide on the needle clamp.
11. Eye of the needle.
12. Hole in the lifting presser foot.

Figure 10-16.—Threading the 7-33 sewing machine.

(3), down and under the tension discs (4). Pass the thread into the loop of the thread takeup spring (5), under the wire loop (6), up, and from back to front through the hole in the thread takeup lever (7). Now pass the thread down through the thread guide (8), into the slot in the vibrating presser bar (9), and on down through the thread guide (10) which is located on the needle clamp. The needle is now threaded from left to right through the eye of the needle (11). After the needle is threaded as shown in figure 10-16, pass the thread down through the hole in the lifting presser foot (12). Draw about 4 inches of thread through the hole in the lifting presser foot with which to commence sewing.

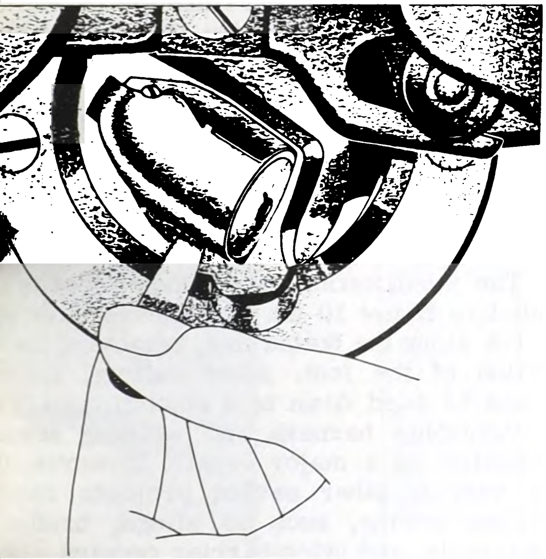
Notice that the lubricating cup has been bypassed. No lubricant is used on the threads and cords used in the manufacture or repair of parachutes.

Removing the Bobbin

Turn the balance wheel forward to bring needle bar and thread takeup lever to its low position. With the aid of the shuttle open tool or a small screwdriver, insert the bla end in the slot in the spring latch beneath shuttle cylinder (fig. 10-17). Press the la away from the cylinder and it will swing o The bobbin will then slide out of the shut cylinder.

Winding the Bobbin

Place the bobbin on the bobbin winder spin and push it up closely against the shoulder. T small pin in the shoulder must enter the s in the bobbin.



ure 10-17.—Removing the bobbin from the shuttle cylinder.

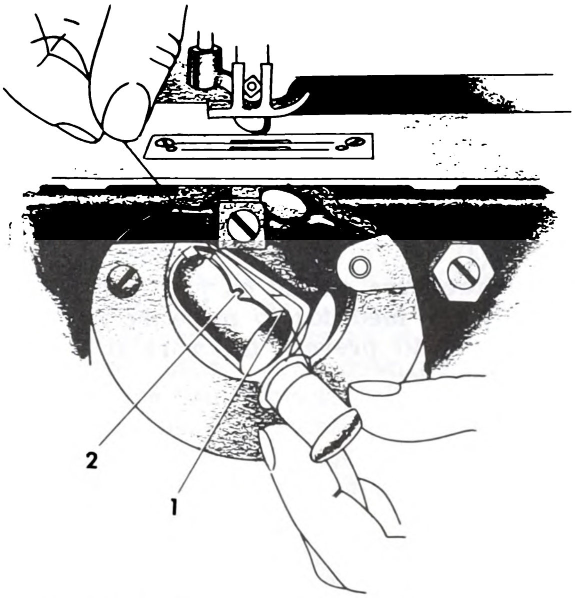
Pass the thread from the thread stand through hole in the left side of the bobbin from the de. Push the bobbin winder pulley up against balance wheel and place the bobbin winder h in position. Raise the presser foot and t the machine. The end of the thread should ıeld until a few turns are wound on the bobbin prevent slipping. When sufficient thread has n wound on the bobbin, the bobbin winder will automatically.

lacing the Bobbin and Threading Shuttle

Take the bobbin between the thumb and fore-ger of the left hand as shown in figure 10-18. free end of the thread should be drawn off m the underside toward the right. Place the bin in the shuttle cylinder as far as it will go. w the thread into the slot in the cylinder and under the tension spring into the delivery (2). Push the shuttle cylinder in until it is ked by the spring latch. There should be ut 3 inches of thread hanging free from the ttle with which to commence sewing.

ulating the Tensions

The tension on the needle thread is regulated the thumb nut at the front of the thread retainer discs. The tension on the thread retainer discs should be just enough to cause the tension wheel to turn when the thread is taken from the spool.



1. Thread slot in the cylinder.
2. Delivery eye and tension spring.

Figure 10-18.—Replacing the bobbin and threading the shuttle.

The tension on the bobbin thread is regulated by the small screw which holds the tension spring to the shuttle cylinder. To increase the tension, turn the screw clockwise. To decrease the tension, turn the screw counterclockwise.

The tension on the machine and bobbin threads should be checked by test running a row of stitches on scrap material. The lockstitch should lock in the center of the material as described for the 31-15. When sewing webbings with the 7-33 sewing machine, the specifications for webbing sewing should be checked to determine at what ply of the webbing the stitch should lock.

Regulating the Length of Stitch

The procedure for regulating the stitch on the 7-33 sewing machine is the same as for the 31-15.

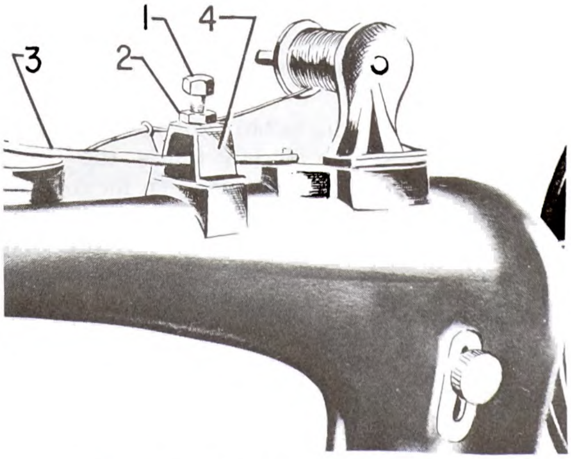
Regulating the Pressure on the Material

The pressure on the material is regulated by means of the hexagon head screw (1, fig. 10-19). Loosen the hexagon head locknut (2) and turn the adjusting screw clockwise to increase the pressure or counterclockwise to decrease the pressure on the spring (3). When the desired pressure has been obtained, hold the adjusting screw with a wrench to keep it from turning while the locknut is being tightened against the bracket (4).

The pressure should be just heavy enough to enable the feed dog to move the work along evenly, and to prevent the work from rising with the needle.

Preparing for Sewing

The same sewing preparatory procedures are used for the 7-33 as for the 31-15 sewing machine except there is no knee lifting device. The hand presser bar lifter is the only device provided for lifting the presser foot on the class 7-33 sewing machine.



1. Hexagon head adjusting screw.
2. Hexagon head locknut.
3. Spring.
4. Bracket.

Figure 10-19.—Regulating the pressure on the material.

Removing the Work

Stop the machine and raise the thread take lever to its highest position. Draw about 3 inch of thread through the thread retaining dis Raise the presser foot and draw the work ba cutting the threads close to the material. Lea the ends of the threads under the presser fo

Modification of Presser Foot for Webbing Sewing

The modification of a presser foot is illu trated in figure 10-20. The presser foot shou be cut along the dotted line, removing the ri portion of the foot. After cutting, the edg should be filed down to a smooth round finis

Parachute harness and webbing sewing classified as a major repair. However, the are various other sewing projects requiri webbing sewing, such as slings, bridles tow targets, and nylon barrier repairs.

ROTARY TYPE SEWING MACHINES

SINGER SEWING MACHINES CLASS 111

111 W 150 Sewing Machine

The 111 W 150 sewing machine is a hig speed, single-needle, lockstitch, compound fe machine employing a belt driven rotary ho with a vertical axis. It is designed for sewi mediumweight fabrics such as flight clothin nylon, twills, and lightweight canvas.

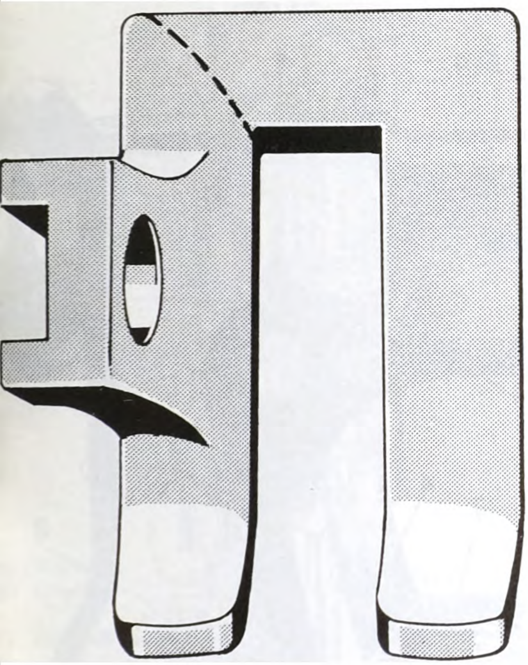
111 W 151 Sewing Machine

The 111 W 151 sewing machine is also single-needle, lockstitch, rotary hook machin intended for high-speed straight stitching mediumheavy materials.

The 111 W 151 sewing machine differs fro other models of the class 111 machines in th it has a single presser foot instead of alternating presser foot.

111 W 152 Sewing Machine

The 111 W 152 sewing machine is a singl needle, lockstitch, compound feed machine wi a vertical axis sewing hook. This machine h alternating pressers with a 3/8-inch lift. has a safety clutch which prevents the ho from being damaged or getting out of time d to accidental strain.



igure 10-20.—Modification of presser foot for webbing sewing.

W 153 Sewing Machine

The 111 W 153 sewing machine is similar he 111 W 152, but it is used for sewing heavy k such as automobile and truck upholstery, s, awnings, and leather flight jackets.

W 154 Sewing Machine

The 111 W 154 sewing machine is also ilar to the 111 W 152, but its alternating ssers have a lift of 1/2 inch and the machine lesigned for stitching upholstery work and her coats and binding heavy materials such elt padding.

W 155 Sewing Machine

The 111 W 155 sewing machine is similar the 111 W 154 except that its maximum ch length is 3 1/2 to the inch, and it has adjustable lifting eccentric for instantly ing the alternating pressers to the minimum unt of lift required for the work to be sewn.

Lubrication of the Class 111 Sewing Machines

Figures 10-21 through 10-24 show the various lubrication points on class 111 sewing machines. Oiling points are indicated by the unnumbered arrows. Familiarization with the nomenclature of the machines may also be accomplished by studying these illustrations.

To lubricate the class 111 machine, swing back the top cover and oil the bearings, then replace the cover.

Loosen the thumbscrew in the upper end of the faceplate, turn the faceplate upward, and oil the wick and bearings as shown in figure 10-22. After oiling, turn down the faceplate and tighten the thumbscrew.

Turn the machine back on its hinges and apply oil at the places designated by the arrows in figure 10-24. All contacting parts on the bottomside of the machine should also be oiled.

To lubricate the hook, remove the bed slide and place oil in the oil well (fig. 10-23). This will lubricate the upper hook bearing and the mechanical opener mechanism.

The small green felt pad on the side of the bobbin case should be kept wet with oil to lubricate the hook race. When this pad is wet, it appears nearly black; when it appears light green, it indicates that it is dry. When a machine is new, oil should be applied to this felt pad EACH TIME A BOBBIN IS REPLACED.

Needles and Thread

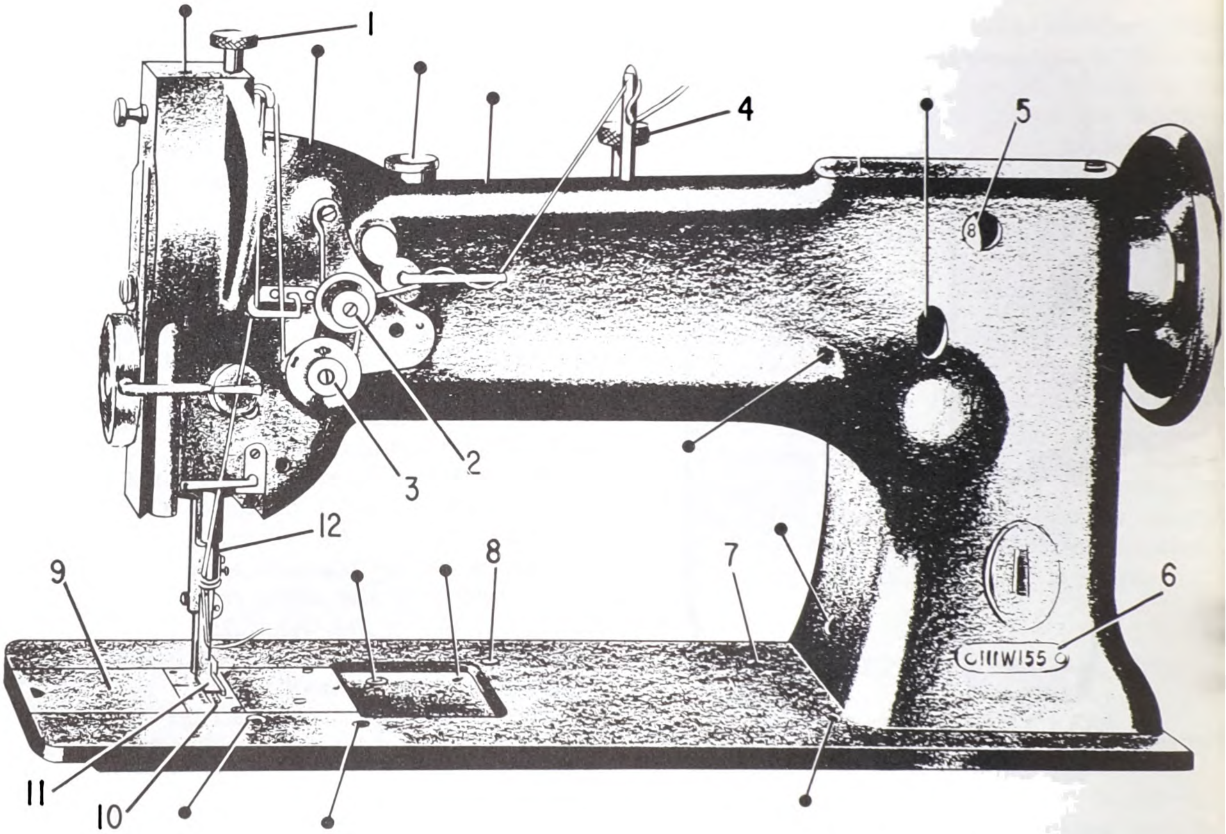
The thread used on rotary type sewing machines is left twist. To determine the twist of thread, refer to figure 10-6.

Table 10-3 lists the class and variety of needle and the needle size range for each of the class 111 machines.

The size of needle to be used is determined by the size of the thread used. The thread must pass freely through the eye of the needle. If rough or uneven thread is used, or if it passes with difficulty through the eye of the needle, the machine will not function properly.

Needles used on rotary type sewing machines are ordered the same way as those for oscillating type sewing machines.

The needles for the rotary type sewing machines have 7 parts. This is one more part than the needles for the oscillating machines. The additional part is the SCARF, which is a small indention just above the short thread

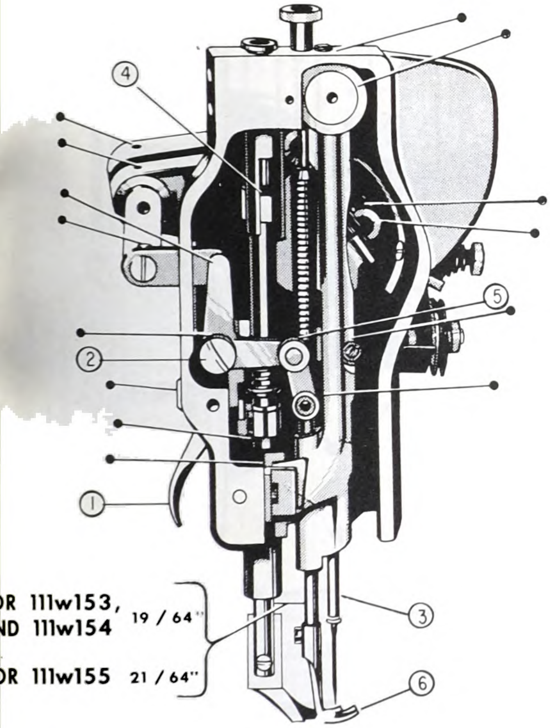


1. Vibrating presser bar thumbscrew.
2. Tension thumb nut.
3. Thread controller stud thumb nut.
4. Presser bar spring regulating screw.
5. Stitch indicator disc view hole.
6. Model number.
7. Hook driving shaft lock stud.
8. Feed regulating stud (plunger).
9. Bed slide.
10. Throat plate.
11. Presser foot.
12. Needle bar.

Figure 10-21.—Front of machine, showing oiling points.

Table 10-3.—Data for class 111 sewing machines.

Sewing Machine	Stitches per minute	Stitches per inch	Needle class and variety	Needle size rang
111 W 150	3,500	5 to 32	135 x 7	7 to 24
111 W 151	3,500	5 to 32	135 x 17	14 to 26
111 W 152	2,900	5 to 32	135 x 17	12 to 24
111 W 153	2,900	5 to 32	135 x 17	12 to 24
111 W 154	2,900	5 to 32	126 x 11	22 to 27
111 W 155	3,500	3 1/2 to 32	135 x 17	12 to 24



1. Hand lift for presser foot.
2. Vibrating presser bar thumbscrew.
3. Needle bar.
4. Vibrating presser bar.
5. Presser bar.
6. Presser foot.

Figure 10-22.—End of machine, showing oiling points.

ove. The purpose of the scarf is to permit point of the sewing hook to come close enough pick up the needle thread without striking needle.

ration

Operation of the rotary type sewing machines the same as for the oscillating sewing chines.

ing the Needle

Turn the balance wheel toward you until the dle bar moves up to its highest position. sen the setscrew in the needle bar and slip needle up into the bar as far as it will go. The needle must be inserted with its long thread groove toward the left; the eye of the needle being directly in line with the machine bed. Retighten the setscrew.

Threading the Machine

Pass the thread from the thread stand from back to front through the lower hole (1, fig. 10-25) in the thread post on top of the machine, then from right to left through the upper hole (2) in the post. Pass the thread down through hole (3), up through hole (4), and down through hole (5) in the thread guide on the front of the machine. Continue the thread over from right to left between the tension discs (6), and down, from right to left around the thread controller (7). Then the thread should go up into the fork (8) in the thread controller disc against the pressure of the wire controller. The thread is then passed up through the thread guide (9), and from right to left through the hole in the thread takeup lever (10). Pass the thread down through the thread guide (11), and between the felt pad and the felt pad retainer finger (12). (If the machine you are threading does not have the felt pad and retainer finger installed, bypass this component.) Finish the threading by passing the thread down through the thread guide (13), through the thread guide (14) at the bottom of the needle bar, and from left to right through the eye of the needle (15). Always thread a needle toward the bobbin.

Removing the Bobbin

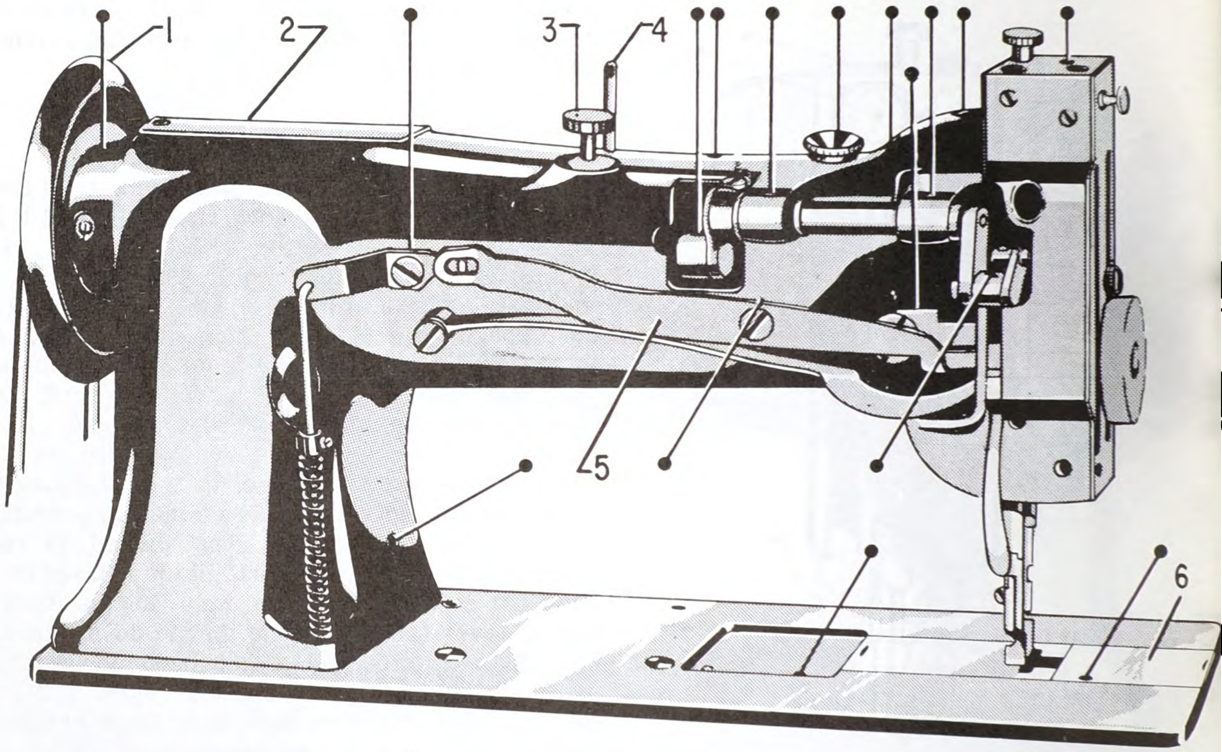
To remove the bobbin draw out the slide plate in the bed of the machine. Insert the fingernail of the forefinger under the latch, raise the latch, and lift the bobbin out. (See fig. 10-26.)

Winding the Bobbin

To wind the bobbin and adjust the bobbin winder, follow the procedure given for the 31-15 sewing machine.

Replacing the Bobbin and Threading the Bobbin Case

Hold the bobbin between the thumb and forefinger of the right hand with the thread drawing out on the bottom from left to right. Place the bobbin on the center stud of the bobbin case, then push down the latch.



1. Balance wheel.
2. Top cover.
3. Presser bar spring regulating screw.
4. Thread post.
5. Knee lift linkage.
6. Bed slide.

Figure 10-23.—Rear of machine, showing oiling points.

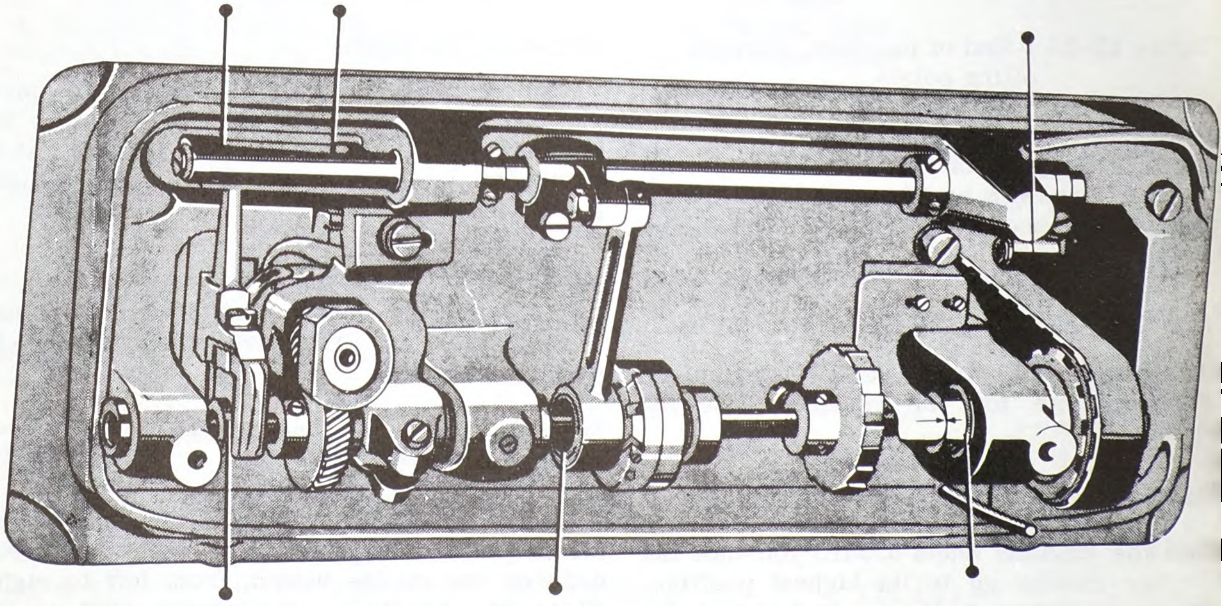
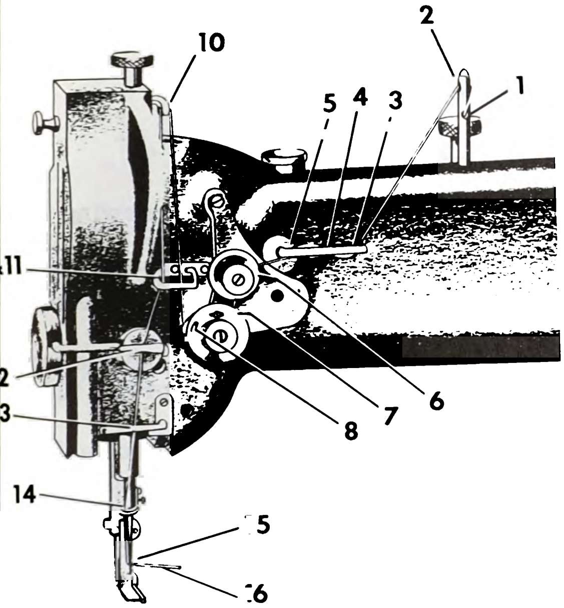


Figure 10-24. Base of machine, showing oiling points.

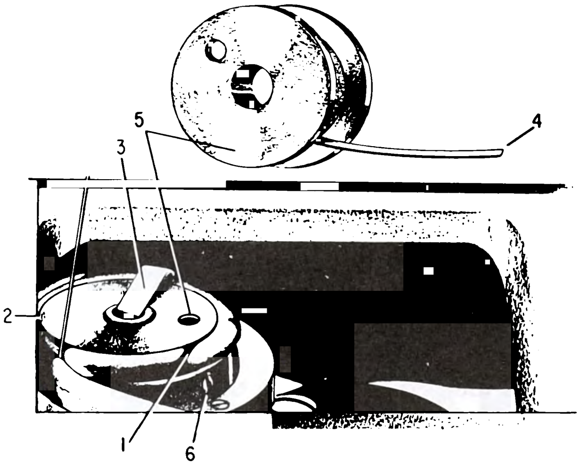


1. Lower hole in thread post.
2. Upper hole in thread post.
3. Hole in thread guide.
4. Hole in thread guide.
5. Hole in thread guide.
6. Tension discs.
7. Thread controller.
8. Fork in the thread controller.
9. Thread guide.
10. Thread takeup lever.
11. Thread guide.
12. Felt pad and retainer finger.
13. Thread guide.
14. Thread guide.
15. Eye of needle.
16. Free end of thread.

Figure 10-25.—Threading the class 111 sewing machines.

Draw the thread into the slot (1), and under back of the projection (2). Leave a loose end thread about 2 inches long above the side. en closing the slide plate, leave just enough ace for the thread to pass through when it is st picked up by the needle.

gulating the Tension



1. Slot in the bobbin case.
2. Projection on the bobbin case.
3. Bobbin case latch.
4. End of bobbin thread.
5. Bobbin.
6. Tension adjusting setscrew.

Figure 10-26.—Bobbin case threaded.

The tension on the needle thread is regulated the tension thumb nut located at the front of the tension discs on the front of the machine. To increase the tension, turn this thumb nut clockwise. To decrease the tension, turn the thumb nut counterclockwise.

The tension on the bottom (bobbin) thread is regulated by means of the small screw nearest the center of the tension spring on the outside of the bobbin case, as shown in figure 10-26. To increase the tension, turn this screw clockwise. To decrease the tension, turn the screw counterclockwise.

Regulating the Length of Stitch

The number of stitches per inch is stamped on the stitch indicating disc which can be seen through the hole on the uprise.

To change the length of stitch, press down the feed regulating stud (plunger), located in the bed of the machine. At the same time turn the balance wheel slowly until the plunger enters a notch in the adjustable feed eccentric cam. Continue to hold the plunger and turn the balance wheel forward or backward until the number of stitches per inch desired can be seen through the hole in the front of the uprise. Disengage the plunger by releasing it.

Regulating the Pressure on the Material

The pressure on the material is regulated by the presser bar regulating screw at the back of the sewing machine. The screw acts on a flat spring. To increase the pressure, turn this screw downward. To decrease the pressure, turn this screw upward. The pressure should be only heavy enough to enable the feed to move evenly along whatever thickness of material you are using.

Preparing for Sewing

With the left hand, hold the end of the needle (machine) thread, leaving it slack from the hand to the needle. Turn the balance wheel over toward you until the needle moves down and up again to its highest position. If the sewing machine is properly timed, this will bring the bobbin thread up with the machine thread through the hole in the feed dog. Lay the threads back under the presser foot and close the slide.

Place the material under the presser foot. Lower the presser foot either by hand or by the knee lift, and commence to sew. Start the sewing by turning the balance wheel over toward you as you depress the treadle.

Removing the Work

After the machine has stopped, move the thread takeup lever to its highest position. Raise the presser foot, draw the work back, and cut the threads close to the material. Lay the ends of the threads back under the presser foot.

SINGER SEWING MACHINE 112 W 140

The 112 W 140 sewing machine has two needles, two belt-driven rotary sewing hooks, and makes the lockstitch. It has a compound feeding mechanism, consisting of needle and drop feed. This machine is designed for stitching flight suits, coats, and other light and medium weight fabrics requiring a compound feed.

For bulky work such as tents, awnings, etc., which require two simultaneous parallel rows of lockstitching, the 112 W 116, equipped with a puller feed, is recommended.

Needles for machine 112 W 140 are of class and variety 135 x 7 and are made in sizes from 12 to 24.

When the machine is new, it should not be driven at a speed exceeding 3,000 stitches per minute. After the first few days, the mach may be driven at its recommended maxim speed of 3,500 stitches per minute. This sp depends on the nature of the work and the abi of the operator.

Lubrication

All the parts of the 112 W 140 sewing mach can be oiled without turning the machine b on its hinges. Oil should be applied to each the places designated by arrows in figures 10- 10-28, and 10-29.

The type of oil to be used and the interv of oiling are the same as given for the 111 ser sewing machines.

The hook is lubricated as shown in fig 10-30. Oil should be placed in the oil well indicated. The oil will flow to both the upp and lower bearings and also lubricate mechanical opener mechanism.

The small green felt pads on the side of ea bobbin case should be kept wet with oil to lub cate the hook races. When these pads are v they appear nearly black; when they appear lig green, it indicates they are dry. When a machi is new, oil should be applied to these felt pa each time a bobbin is replaced.

Setting the Needles

Turn the balance wheel over toward you un the needle bars and the thread takeup lev moves to its highest position. Loosen the se screw in the needle holders and slip the needl up into the holder as far as they will go. Ma sure the inside needle (one nearest the uprig part of the arm) has its long thread groo toward the left. The outside needle (one farthe from the upright part of the arm) must ha its long thread groove toward the right. T eyes of both needles must be directly in li with the machine bed. After aligning the needle tighten the setscrews.

Replacing the Bobbins and Threading the Bobbin Cases

The removal and winding of the bobbins accomplished the same as for the 111 sewi machines. Both bobbins should be wound a replaced at the same time.

The following instructions apply to both of t bobbin cases.

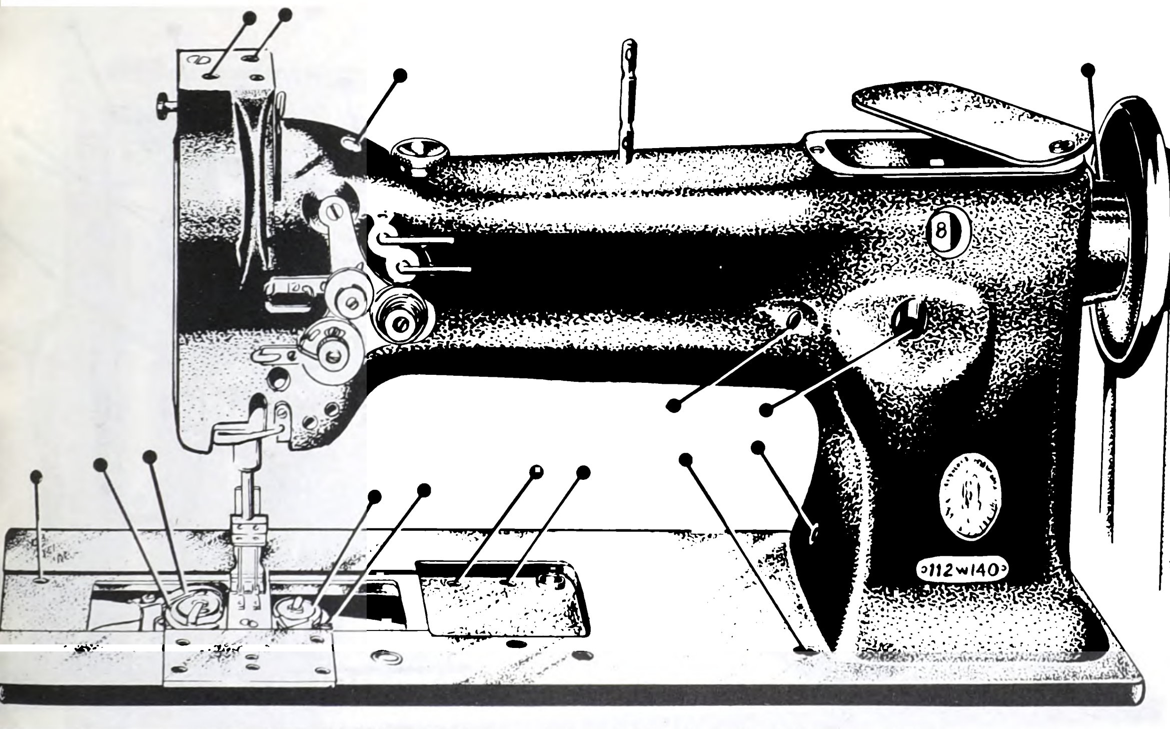


Figure 10-27.—Oiling points at the front of the machine.

Iold the bobbin between the thumb and fore- er of the right hand, the thread drawing the bottom from left to right. Place the bin on the center stud of the bobbin case then down the latch, as shown in figure 10-31. Draw each thread into the slot (1) located he edge of the bobbin case, and back of the ection (2). Leave a loose end of each thread it two inches long above the slide. When ing the slides, leave just enough space for threads to pass through when being picked y the machine threads.

eading the Machine

The 112 W 140 sewing machine is threaded ractically the same way as the 111 series hines. The only exception is that there are upper thread guides and two tension discs, shown in figure 10-32. With the exception of upper thread guides and tension discs, the threads run parallel. Each needle is threaded n inboard to outboard (always toward the bin).

After the machine has been threaded, the preparation for sewing and removal of the work are the same as for the 111 series machines.

Adjusting the tensions, regulating the length of stitch and regulating the pressure on the material are also accomplished the same as for the 111 sewing machine.

SINGER SEWING MACHINE 143 W 2 AND 3

The zigzag sewing machine is an excellent sewing machine for the manufacture of parachutes. This type of machine is not as common as those previously described, but it has unlimited uses in the repair and maintenance of parachutes and survival equipment and will be found in many parachute lofts.

The 143 W 2 is a high-speed sewing machine which has an aluminum alloy vibrating needle bar frame and a rotary hook. It is intended for overseaming and zigzag stitching on fine and general fabrics and lightweight leather. It has ball bearings on the rear end of the arm shaft and hook driving shaft. The needle bar has a

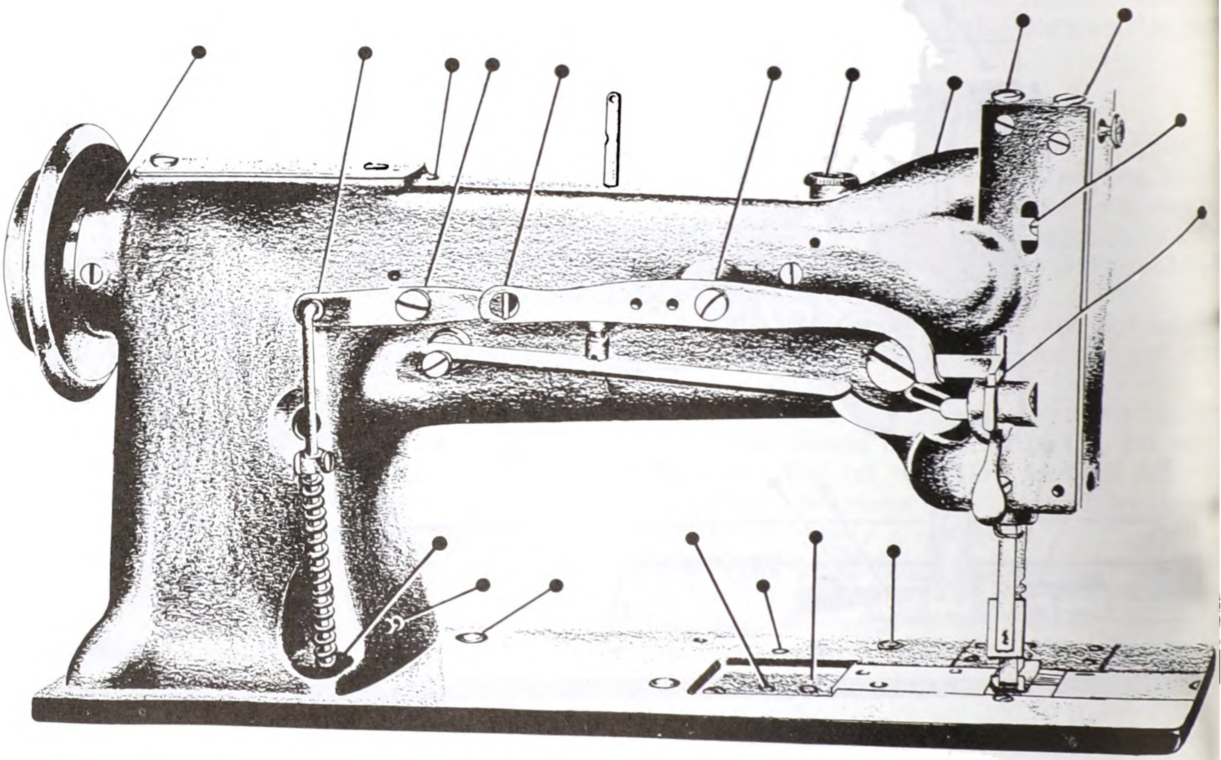


Figure 10-28—Oiling points at the back of the machine.

maximum throw of 3/16 inch, vibrating both sides of a centerline.

The 143 W 3 sewing machine is similar to the 143 W 2 except that the needle has a maximum throw of 5/16 inch.

The maximum speed recommended for machine 143 W 2 is 3,500 stitches per minute, and for machine 143 W 3, 3,000 stitches per minute, the speeds depending on the material being sewn.

Lubrication

Lubrication points for these machines are indicated by arrows in figures 10-33 through 10-36. When in continuous use, they should be oiled twice a day.

Needles and Thread

The needles for the 143 W 2 and 3 sewing machines are of class and variety 135 x 7; the sizes from 7 to 24.

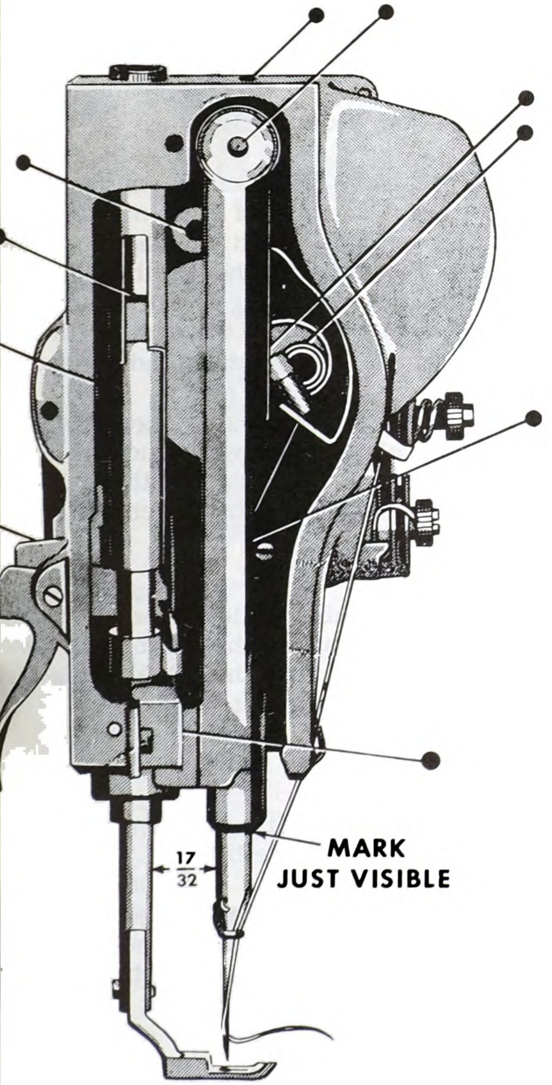
Left twist thread should be used on th machines. To make a smooth even stitch w the sewing machine, use good, firmly twis and smoothly finished thread. The thread sho pass freely through the eye of the needle.

Setting the Needle

Push the needle up in the needle bar as as it will go, with the LONG THREAD GROO TO THE FRONT, and secure it firmly with setscrew. It may be necessary to turn the nee slightly to the right or left for some thre if stitches are missed.

Bobbin and Bobbin Case

The procedure for removing the bobbin ca winding the bobbin, threading the bobbin ca and replacing the bobbin case is the same for the 31-15 sewing machine. The only ception to this is that when threading the bob case, the thread should draw from the BOTT



gure 10-29.—Oiling points at the end of the machine.

n left to right, instead of from the top iven for the 31-15.

eading the Needle

These machines are threaded in the same as the 111 series machines, described lier in the chapter. When threaded up to the dle, thread the needle from the front through eye to the back. The long thread groove uld be in front when the needle is properly in the needle clamp.

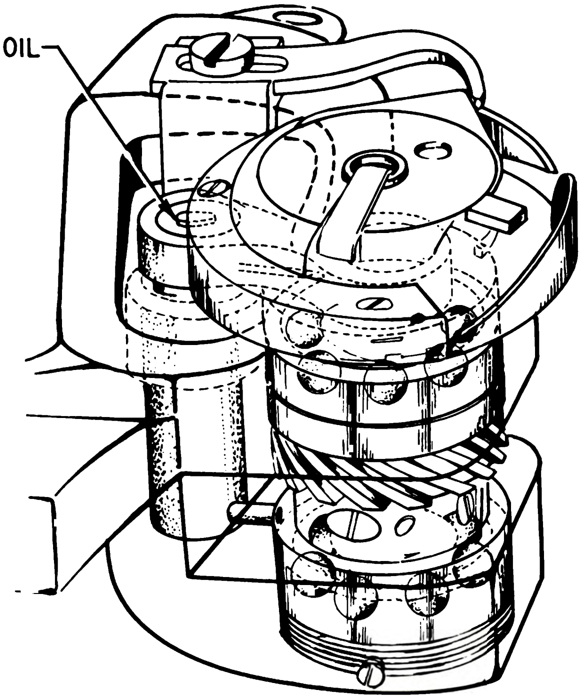
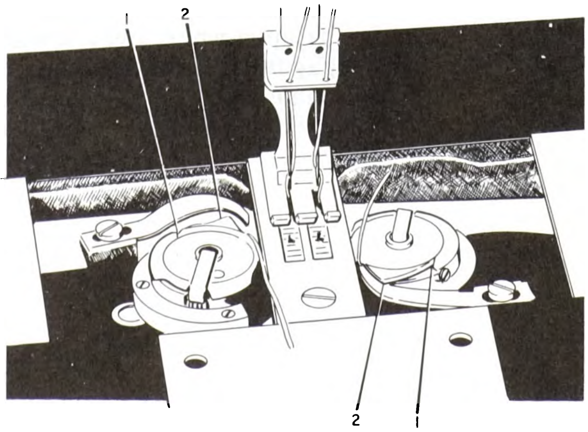
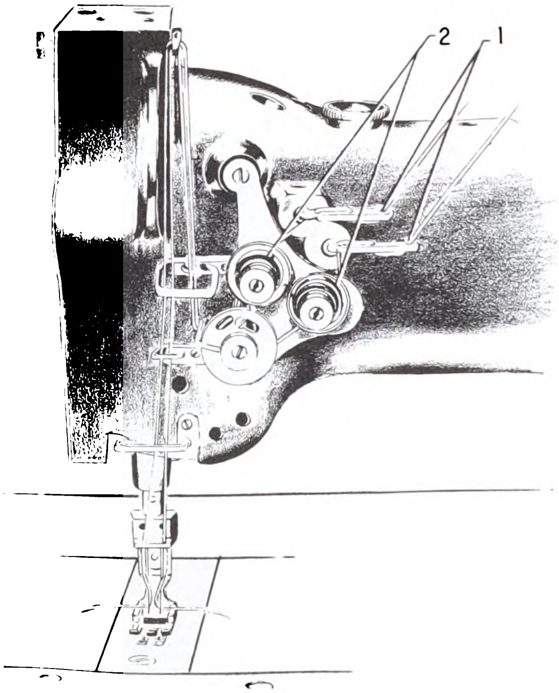


Figure 10-30.—Hook lubrication.



1. Slot in the edge of the bobbin case.
2. Projection on the side of the bobbin case.

Figure 10-31.—Threading the bobbin case.



1. Upper thread guides.
2. Tension discs.

Figure 10-32.—Threading the 112 W 140 sewing machine.

Regulating the Length of Stitch

Press the stitch regulator lever and at the same time turn the balance wheel over toward you until the lever engages the notch in the stitch regulator flange. Continue to hold the lever in the notch in the flange and at the same time turn the balance wheel backward or forwa as required. When the desired number stitches is obtained, as indicated on the sti regulator flange (seen through small holes the upright above the lever), release the lev

Regulating the Width of Bight

The width of bight of the zigzag stitch regulated by means of the needle vibrat regulating spindle head on the front of t machine. To increase the width of the zigz stitch, turn the regulating spindle head counte clockwise. To decrease the width of the zigz stitch, turn the regulating spindle head cloc wise.

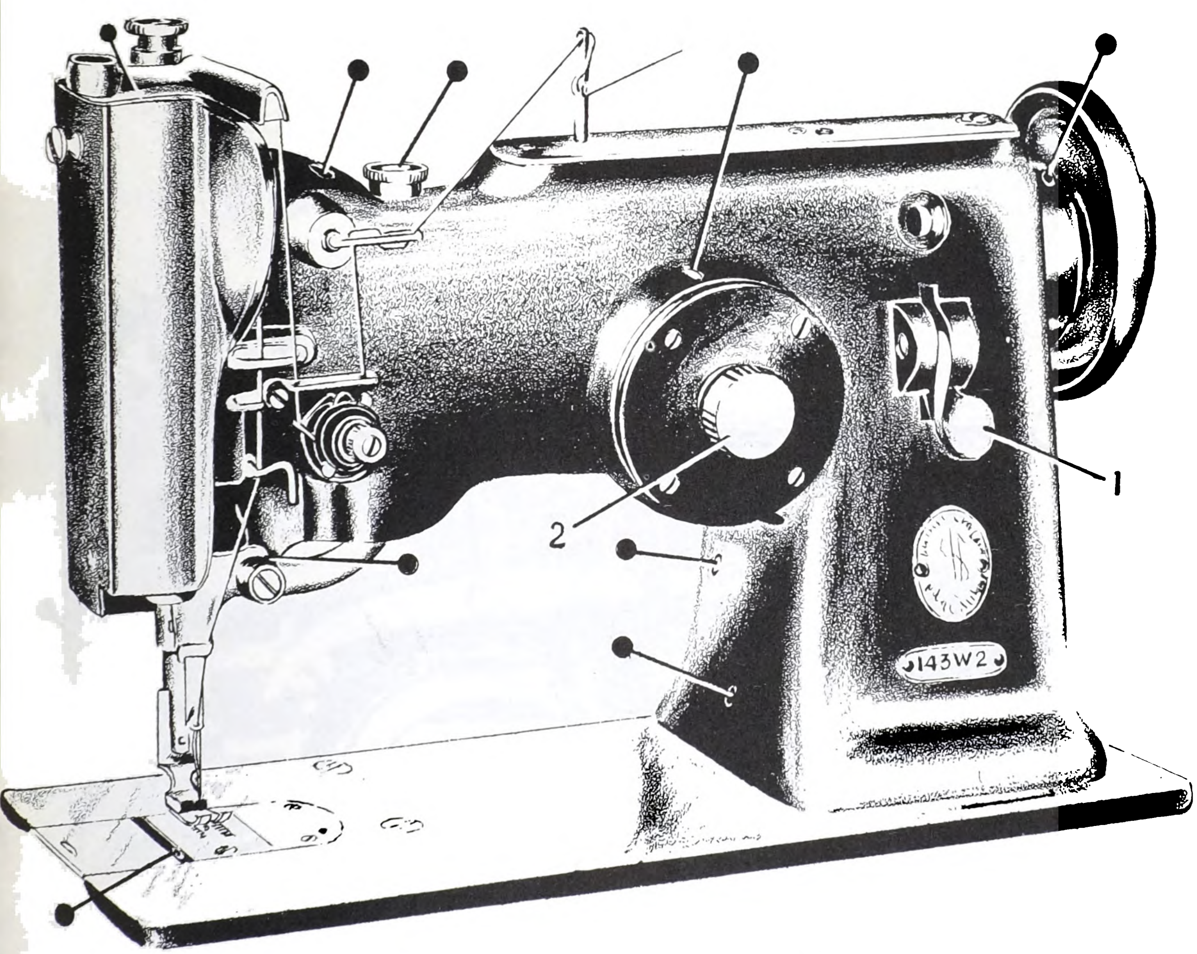
The thread tensions are regulated as giv for the 111 class machines, and the pressu on the material is regulated by the thumbscre located on top of the sewing machine.

Turning Corners

Stop the machine while the needle is risi but before it is out of the material, raise t presser foot and turn the work. This meth uses the needle as a pivot.

Removing the Work

Raise the presser lifter (either hand or kne turn the machine by the balance wheel until t takeup lever is at its highest position a draw the work away from you. If the threa do not draw out easily, the takeup lever is n in the right position. If the machine is stopp as directed, the needle will not be unthread when starting to sew, even if only a short e is left through the eye of the needle.



1. Stitch regulator lever.
2. Vibrator regulating spindle head.

Figure 10-33.—Oiling points at front of machine.

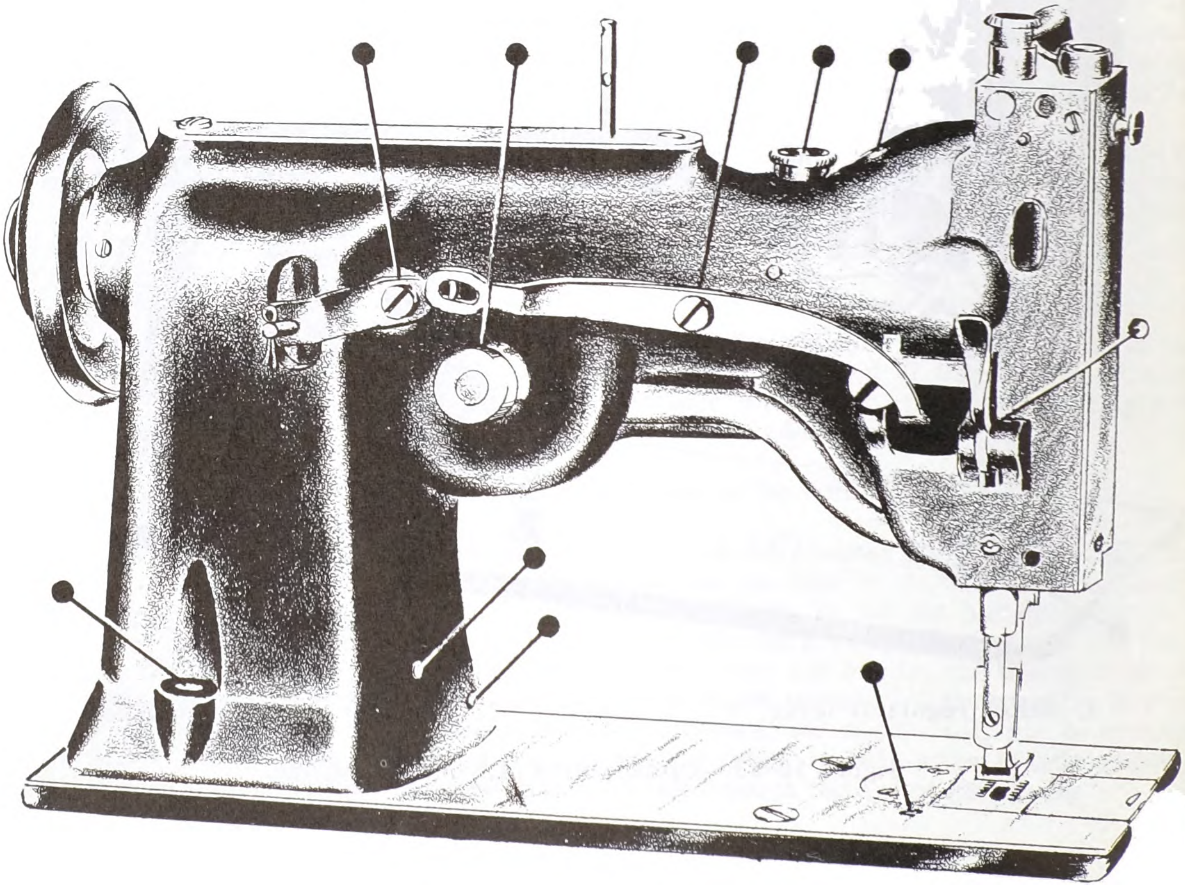


Figure 10-34.—Oiling points at back of machine.

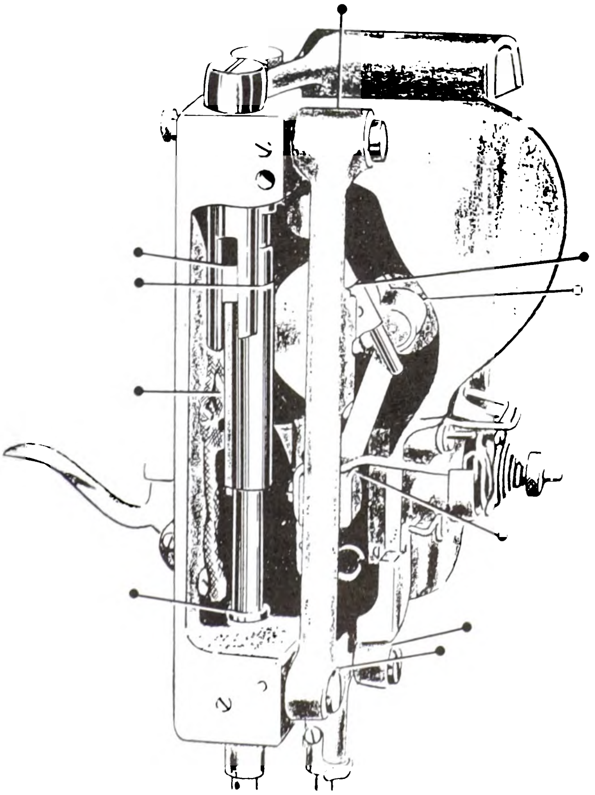


Figure 10-35.—Oiling points at end of machine.

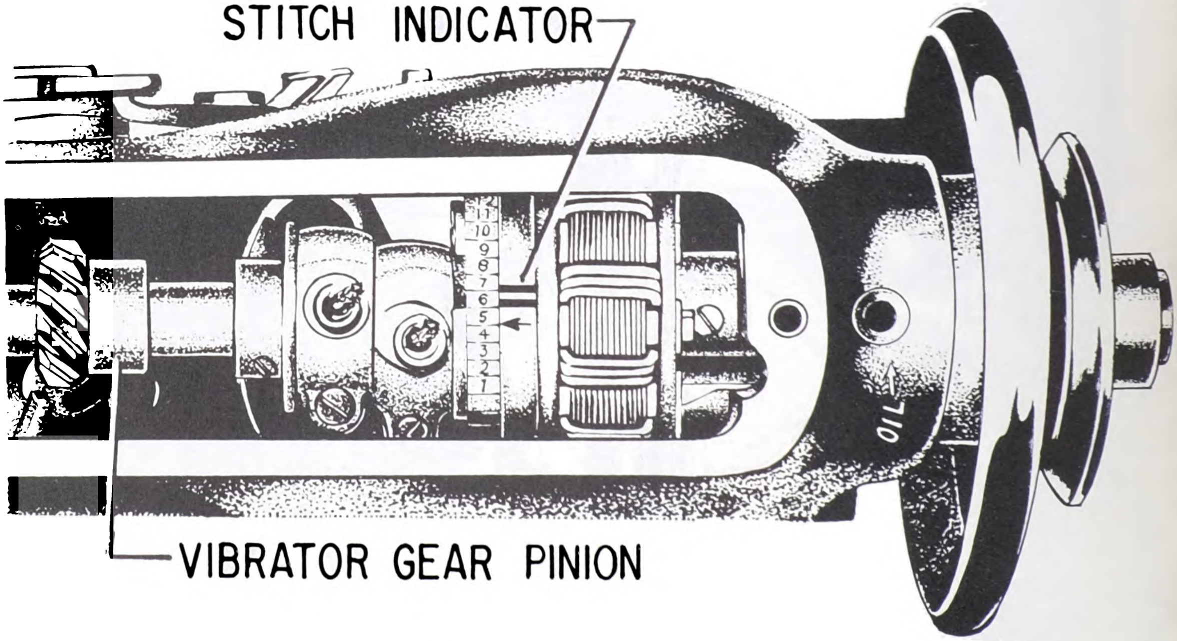


Figure 10-36.—Oiling points at top of machine.

CHAPTER 11

PARACHUTE MAINTENANCE AND REPAIRS

FABRIC MATERIALS

Iaterials used in parachute construction
of the very best grade obtainable. All of
e materials—the fabric, webbings, cords,
s, hardware, etc.—are made in accordance
strict government specifications.

specification is a written document con-
ng the details of construction and minimum
dards for an item of material or equipment
h has been ordered by a using activity. In
case of the Armed Forces, specifications
necessary to insure that the item ordered
ts all the requirements for which the govern-
t is paying and that the item will perform
he necessary functions.

The Armed Forces now procure most of
r materials and equipment under a coordi-
d program. Items procured under this
ram are assigned a Military (MIL) Specifi-
on Number. The MIL Specification Numbers
d in this chapter are now in effect. However,
ifications are revised from time to time,
specification numbers are often changed,
eled, or superseded. The Index, List of
tary Specifications and Standards, NW
5-544, lists all specifications in effect and
e recently canceled. This Index is reissued
odically under the supervision of the Bureau
Naval Weapons and is available in your
nical library.

s a Parachute Rigger, you must not tolerate
use of substitutes or substandard materials
le fabrication or repair of survival equip-
t. A knowledge of specifications and tensile
ngths will better equip you to design local
ects which must meet specified tensile
ngth requirements.

ES OF FABRIC MATERIALS

n Parachute Cloth

lylon parachute cloth is made in accordance
Specification MIL-C-7020D. This cloth is neutral in color unless otherwise specified, and is used in constructing the gores and panels of the parachute canopy. The specification states that the maximum weight cannot be more than 1.1 ounces per square yard. The breaking strength in minimum pounds per inch of width is 42 pounds. The minimum tear resistance is 5 pounds for both the warp and filler thread. The air permeability in cubic feet per minute per square foot of cloth is 80 to 120.

Nylon Cord

Nylon cord used for suspension lines for pilot chutes and parachutes is made in accordance with Specification MIL-C-5040B (ASG). Type I cord, 100 pounds breaking strength, is used for the lines of Martin-Baker pilot chutes. Type III, 550 pounds breaking strength, is used for constructing the suspension lines of the canopies of all service parachutes.

Nylon Reinforcing Tape

Reinforcing tape comes in many widths and styles. This tape is used on parachute container reinforcements, edgings, hesitator loops and retainers, and general strengthening of all stress areas. Tapes are made in accordance with Specification MIL-T-5038A-1.

Many of the tapes can be identified by observing the patterns of their weaves. Type II tape is a plain weave. Type IV tape is composed of two ground warps. Type VI tape is a herringbone style which differs only slightly from Type IV.

Type II tape is 3/4 inch wide and has a minimum breaking strength of 400 pounds. Type IV tape comes in both 1-inch and 1 1/2-inch widths. The 1-inch width has a minimum breaking strength of 1,000 pounds, while the breaking strength of the 1 1/2-inch is 1,500 pounds. Type VI tape is 3/4 inch wide and has a breaking strength of 425 pounds.

Nylon Webbing

Soft textile nylon webbing is used for constructing parachute harnesses. This webbing, 6,000 pounds breaking strength, is olive drab in color. The width is 1 23/32 inches ± 1/16 inch.

Nylon Tubular Webbing

Nylon tubular webbing is neutral in color and is used in reinforcement of the parachute canopy.

These tapes and webbings are covered in the following specifications:

MIL-W-4088D.
MIL-T-6134B.
MIL-W-5625D.

The 1-inch nylon tubular webbing has a breaking strength of 3,000 pounds and is used for the vent reinforcement. The nylon warp and cotton filler webbing is also 1 inch and has a breaking strength of 525 pounds. It is used to reinforce the skirt hem. The 1/2-inch tubular webbing has a breaking strength of 1,000 pounds and is used for the Martin-Baker pilot chute connector cord.

ENEMIES OF FABRICS

DAMAGE BY ACID

Contamination by acid is probably the most serious damage which can be sustained by parachutes, mainly because the action is rapid and can have far-reaching effects. Unless constant vigilance is maintained for acid detection, contamination and weakening of the parts of the parachute may proceed undetected and might result in serious consequence in the event of emergency use. It is imperative that the utmost care be taken by all personnel to prevent acid from contacting parachute equipment. Only clean vehicles should be used for transporting parachutes in operating units; and particular caution should be observed so that parachutes are not transported in vehicles previously used for transporting wet-cell storage batteries.

Any item of parachute equipment suspected of having been in contact with acid must be isolated from all other parachute equipment and tested immediately. Similarly, equipment having been in contact with an article known to be contaminated must be isolated and tested. Not only must the complete article be isolated, but
the suspected portions of it must not be allow
to touch any other portion so that the dama
is restricted as far as possible.

Litmus paper provides a reliable and sim
means for detecting the presence of acids
alkalies. Blue and red litmus paper is ava
able through standard stock issue. To test
acid content, dampen the affected area with di
tilled water while touching it with a strip
blue litmus paper. If the blue color turns to r
acid is present. To test for an alkali, damp
the affected area with distilled water wh
touching it with a strip of red litmus paper.
the red color turns blue, an alkali has been d
tected. Immediate steps must be taken
neutralize the caustic and damaging effects
these elements.

Canopies badly stained with grease, oil,
other injurious substances should be return
to a major repair station for repair, aft
steps have been taken to neutralize the damag

Synthetic materials, such as nylon, orl
and dacron, originating from vegetable matt
have one great factor in their favor—the abil
to resist the effects of weather. Nylon, the pri
cipal material used in manufacturing parachut
and certain articles of flight clothing, occupi
a commanding lead among materials for fulfilli
the needs of the Navy. In view of these fac
some individuals become careless and do
always exercise their best judgment in handli
items manufactured from the so called "mira
fibers."

Regardless of the factors favoring nyl
with all its reserves of strength, elasticity, a
durability, prolonged exposure to the destru
tive elements of sunlight, salt water, and d
will dangerously weaken the material, renderi
it useless for further use in a parachute. Pa
of your job is to safeguard the parachute fr
contact with the above mentioned elements, pl
evading the destructive qualities of batte
acid, oils, greases, mildew, and insects.

A stain not only ruins the appearance of
object but could also cause physical damag
We are primarily interested in the damagi
effects of a stain. Certain oils, dirt, food, a
other products contain acids in varying pe
centages.

A strong acid is certain death to fabric a
rapidly brings about the complete deteriorati
of the affected area. The time necessary
bring about its destruction is determined by t
strength of the acid solution. It is your j
during the inspection of the parachute to loca

ed areas and to test these for acid or alka-
content.
Whenever definite evidence of acid contami-
n is found, the damaged parts should be
ed immediately with ammonia to neutralize
acid and be allowed to dry thoroughly. A
ercent solution of 0.880 liquid ammonia
istilled water is recommended, but if not
able, ordinary clear domestic ammonia
be used. The solution should be applied to
ffected part with a swab or small piece of
e tied securely to a stick. Do not be afraid
e an excess of ammonia as this chemical
ot injurious to the material or hardware.
tle of the solution should always be kept in
parachute loft ready for immediate use.
The presence of acid stains on a pack indi-
the possibility of serious contamination
e main and pilot chute canopies and suspen-
lines and calls for very careful inspection
e whole parachute, including the harness.
acks must be inspected daily for signs of
stains, particularly on completion of a flight.
stains can be recognized by their appear-
being putty-colored at first and then
ing to white. The stains are more readily
rnible on the clean interior of a pack than
e outside, which may be soiled.
signs of acid stains are noted, the pack
be opened immediately, the pack put aside
the canopy and pilot chute examined and
d as detailed in the following paragraph.
acid on the pack must be neutralized to
ent further damage and the pack kept iso-
for 10 days and frequently inspected for
er signs of contamination, which should be
ed as they appear. If, after this period, the
ge is small, the affected portion should be
ly cut out and the hole patched; otherwise
ack must be discarded.
The main canopy and pilot parachute released
a pack contaminated with acid, or known
ave been in contact with any piece of equip-
suspected of acid contamination, should be
ted immediately and thoroughly examined
tested for signs of damage. If contaminated
s are discovered, they must be neutralized
nce with ammonia as previously described,
being taken to treat only one thickness of
erial at a time. If ammonia cannot be
ined, the defective portions must be care-
cut out and burned. If the contaminated
is 8 square inches or less, it must be
out and patched. If the contaminated area is
ter than 8 square inches, the affected area
must be neutralized and cut out and the entire parachute sent at once to a major repair station for repairs. Should damages of a small area appear on many of the gores of the same parachute, the entire parachute must be sent to a major repair station for overhaul. Should no signs of damage be found, the canopy must be hung for 10 days, isolated from all other equipment, and frequently inspected to see whether damage becomes evident. If, after this period, there are still no signs of contamination, the canopy may be put back into service.

Contamination of a harness by acid is more serious than to any other portion of a parachute. A harness so damaged must be returned to a major repair station for inspection and possible repair or replacement. Harnesses suspected of contamination must be isolated and tested immediately with litmus paper. Before packing for transport, the parts damaged by acid must be neutralized with ammonia as already described; or in the absence of ammonia, the damaged parts must be cut out and burned. When contamination is suspected, but no definite evidence is immediately detectable, the procedure of isolation and frequent examination for a period of 10 days must be followed. If no damage is detected, the equipment may be put back into service. Whenever an element of doubt exists as to the condition of the harness equipment, it must be discarded for use, in the interest of safety to personnel.

Examination of even a new parachute canopy will reveal occasional slight displacement of threads of the material especially along or near the seams. Normal defects in the weave will also be found. These defects are not detrimental to the strength of the material and need not be corrected. Under no condition should such places be pulled or stretched by hand as such treatment tends to weaken the material and will convert a harmless displacement into a bad strain which will require repair. A strain considered as not warranting repair should be noted on the canopy chart for the information of the major repair station. When weakness of the material is suspected, the canopy should be sent to a major repair station for inspection and possible test.

WATER DAMAGE

River, Lake, or Pond Water

Should a parachute fall into natural fresh water, it must be rinsed as soon as possible in several changes of fresh tap water in a tank or tub and dried. Great care must be taken to handle the material carefully. The water must not be wrung out by twisting the fabric parts in the hands, but must be allowed to drip dry. If a parachute has been immersed in natural fresh water two or more times and there is reason to suspect that the material has been weakened, the parachute should be returned to a major repair station for drop testing. The parachute must be hung to dry in accordance with the procedures previously outlined in chapter 4.

Salt Water

It is imperative that parachutes which have fallen into salt water or become wet from perspiration be subjected to prolonged rinsings with fresh water before being permitted to dry. The effect of the chlorides on nylon canopies is not severe, but nevertheless, these steps must be taken. Chlorides in the form of salt, etc., may be deposited upon the canopy by the introduction of salt water even when total immersion has not occurred.

The parachute must be thoroughly washed after any contact whatsoever with salt water, or upon the appearance of the characteristic stain indicating such contact. Salt can be removed from the material easily, but difficulty will be encountered in removing it completely from the thick parts of the harness. Special attention must be given to those parts where metal fittings are attached, for any remaining traces of salt can result in the start of dangerous corrosive action. The parachute must be immersed in a bath of fresh tap water for 2 or 3 hours in order for the water to dissolve the salt from the inner fibers of the webbing and the thick areas of the seams. For subsequent rinsing, whenever possible, the parachute must be suspended full length by the vent and a gentle stream of fresh water played on it from a hose.

In cases such as aboard small vessels, when the hose and suspension method cannot be employed, parachutes may be rinsed in a tank or tub under a constant stream of running fresh tap water. The rinsing water may be warm but not hot. Aboard ship, always obtain permission before using large quantities of fresh water. Never wring the water out of the canopy by twisting it with the hands or with mechanical wringers, as this causes objectionable wrinkles in the material and may pull it to dangero proportions.

Exposure to direct rays of the sun advers affects nylon, tending to reduce its streng and shorten its life. Drying must be done in t shade. Parachutes which have been immers in salt water for extended periods of time, which have been allowed to dry before rinsin must be forwarded to the nearest major repa station for examination and test of material

Precautions Against Rain, Dew, and Perspiration

Whenever a parachute is in use, it should protected as much as possible from dampnes Packs and/or harnesses must not be left an open cockpit, or anywhere in the open, wh there is the least likelihood of rain or hea dew, nor should they be placed on wet gras Before being placed in lockers or other r ceptacles, packs and/or harnesses should examined for dampness from rain, dew, particularly in the tropics, from perspiratio If found to be damp from perspiration, t directions set forth under "Salt Water" must executed. If found to be damp from rain dew, parachutes must be released, dried, a repacked.

Mildew and Fungus Growth

Parachutes are particularly susceptible mildew in warm humid climates. As the prop gation of fungi or mold is dependent to so degree on a nutrient in the material which m be oil, grease, starch, sizing, or other forei substance, parachutes must be kept as clean possible. In locations where mildew is prevale parachutes must be kept in a tight locker bin, at the bottom of which is placed a suita container for dispensing naphthalene fum Three pounds of napthalene flakes will penetra the parachute sufficiently to prevent the form tion and growth of fungi. Under extreme clima conditions, approximately 1/8 pound of naphth lene flakes should be sprinkled over the unpack parachute within the container, or over the fold gores of the canopy prior to the final foldi operation when packing the parachute.

PARACHUTE CLEANING

Parachutes requiring extensive cleani should be forwarded to a major repair statio

major repair station cannot satisfactorily
the parachute, it should be sent to a com-
ial cleaner for dry cleaning in accordance
established specifications.
hen forwarding parachutes to a major re-
station, a report must be attached to each
hute describing the nature and location of
tains, and the Parachute History Card,
ps 2771, completed. It is of great assist-
when cleaning parachutes to know definitely
her the stains were caused by oil, acid, or
r agents.
arachutes not too badly soiled, or stained,
be cleaned by operating units, provided the
ing directions and precautions are rigidly
ved. Soiled parachutes should be washed
clean, fresh water. The water may be warm
ust not be hot. Sand or dust should not be
ed off; the parachute must be thoroughly
n to remove these foreign substances. If
is caked and dried on the material, the
ce must not be brushed. The affected area
ld be immersed in water, and permitted
oak; the water should be agitated until the
is loosened.
hen dirt and stains are difficult to re-
e by water alone, an approved dry-cleaning
tion may be used. If the harness has
detached, the lines should be chained
ther to reduce the length. All metal parts
ld be covered with heavy cotton flannel.
he harness has not been detached, it and
attaching hardware should be placed in a
ble net bag. After washing the parachute
e cleaning mixture, it should be thoroughly
ed several times in fresh dry-cleaning so-
ns until the rinsing solution remains clear.
parachutes should then be suspended in
hade to dry.
n removing stains and dirt, the stained
must be completely immersed in the clean-
mixture and the liquid agitated while the
erial is held submerged. The flow of the
d around and through the material will be
cient to clean it. The material must not be
ed together or scrubbed with a brush or
saturated with the fluid, as such rough
ling damages and weakens the fabric. Pre-
ed commercial cleaning solutions must not
used since they may cause damage to nylon,
ch is a synthetic material. The use of
mmable fluids in cleaning nylon parachutes
st be avoided, since nylon has a tendency
collect static charges which may result in a
rk that might ignite the fumes.

To remove blood stains, the parachute must be washed in clear, cold water, as warm or hot water coagulates blood and renders it difficult to remove. Drying after cleaning should be done in the shade, in view of the adverse effect of sunlight on the canopy materials. Although the above procedure may be carried out by operating activities when care is taken to insure thorough rinsing, it is strongly recommended that badly soiled parachutes be sent to a major repair station.

STENCILING PARACHUTES AND COMPONENTS

Parachutes are marked by the manufacturer in accordance with the general specifications for parachutes. In order to help identify the parachutes of local units it is permissible to stencil certain external appendages with an approved marking fluid.

The rules for stenciling parachutes locally follow:

1. Use currently approved marking fluid.
2. Avoid marking names directly on the equipment; use a length of tape which can be sewn or tacked to the equipment.
3. The exact place to mark and the size of the lettering depend on the equipment and how it is stored.
4. Identifying marks such as locally assigned numbers must be confined to the back pad and pack.
5. Do not stencil the harness or canopy.

Use an appropriate size (1/2 inch to 1 inch) adjustable metal stencil. Join each letter properly in the grooves provided. When the stencils are joined, align the letters or figures in order to prevent a wavering line. Use the end plates provided in each kit, which offer the necessary margin to prevent smearing the marking ink off the ends. Hold each letter down tightly as the fluid is applied with a dampened brush. Do not attempt to stencil with a wet brush as the fluid will run off in all directions. Wipe the back of the stencil clean with a dry cloth between each operation. Before storing, clean the adjustable stencils in a safe cleaning solvent.

STITCHES, SEAMS, AND STITCHINGS

Federal Standard No. 751 is the official standard specification used in the manufacture and repair of parachutes, survival equipment, and other items which require the use of stitches, seams, or stitchings. The following information is taken from this specification.

CLASSIFICATION OF STITCHES, SEAMS, AND STITCHINGS

As a prerequisite to an understanding of stitches, seams, and stitchings, a clear understanding of their classification and the terms employed in their use is essential.

Stitches

A stitch is one unit of conformation of thread resulting from repeatedly passing a strand or strands and/or loops of thread into or through a material at uniformly spaced intervals to form a series of stitches.

Stitches are divided into six classes which are identified by the first digit of three-digit numerals. Each class is divided into several types which are identified by the second and third digit. These classes are as follows:

100--Chain stitch
200--Hand stitch
300--Lock stitch
400--Multithread chain stitch (double locked stitch)
500--Overedge stitch
600--Flat seam stitch

STITCH CLASS 100.—This class of stitch is formed with one or more needle threads and has for its general characteristic interlooping. A loop or loops of thread or threads must be passed through the material and secured by interlooping with succeeding loop or loops to form a stitch, as shown in figure 11-1.

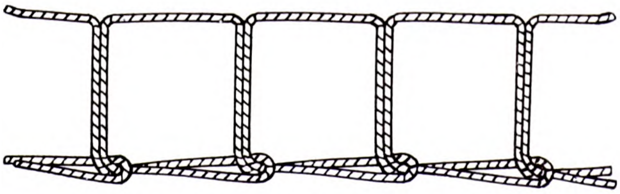


Figure 11-1.—Stitch type 101. This type of stitch is formed with one needle thread which is passed through the material and interlooped with itself on the undersurface of the material.

STITCH CLASS 200.—This class of stitch formed by hand with one or more needle threa Each thread passes through the material a single line of thread, and the stitch is secu by the single line of thread passing in and of the material or interlooping of the threa with themselves. When more than one thr is used, the threads pass through the sa perforations in the material, as illustrated figure 11-2.

STITCH CLASS 300.—This class of stitch formed with two or more groups of threads has for a general characteristic the interlac of the two groups. Loops of the first grou threads are passed through the material wh they are secured by the thread or threads the second group to form a stitch. This is most common type of stitch in use in repair maintenance of parachutes and other survi equipment. It is made by machine and is ill trated in figure 11-3.

STITCH CLASS 400.—This class of stitc formed with two or more groups of thre and has for a general characteristic the int lacing and interlooping of the loops of the groups. Loops of the first group of threads passed through the material and are secured interlacing and interlooping with loops of second group to form a stitch.

STITCH CLASS 500.—This class of sti is formed with one or more groups of thre and loops from at least one group of thread passed around the edge of the material. Lo of one group are passed through the mater and are secured by interlooping with themsel before succeeding loops are passed through material, or secured by interlooping with lo

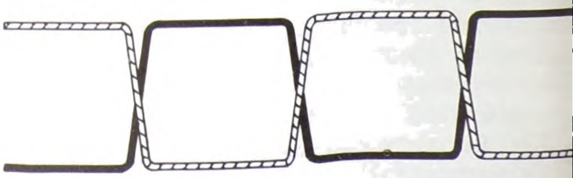
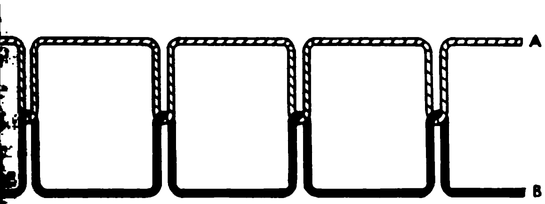


Figure 11-2.—Stitch type 201. This type o stitch is formed with two needle threads (A) and (A') passed through the material in the same perforations from opposite directions without interlacing or interlooping.



ure 11-3.—Stitch type 301. This type of
itch is made with two threads: one needle
read (A) and one bobbin thread (B). One
op of thread A is passed through the
aterial and interlaced with thread B.
read A is pulled back so that the inter-
cing is midway between the surfaces of
material being sewn.

e or more interlooped groups of threads
e succeeding loops of the first group are
d through again.
:

TITCH CLASS 600.—This class of stitch is
ed with two or more groups of threads,
two or more groups cover the raw edges of
surfaces of the material. Loops of the first
of threads are passed through loops of
hird group already cast on the surface of
aterial and then through the material where
are interlooped with loops of the second
on the underside of the material. The one
ption to this procedure is stitch type 601.
is type only two groups of thread are used
he function of the third group is performed
e threads of the first group.

ls

seam is a joint consisting of a sequence of
es uniting two or more pieces of material
is used for assembling parts in the pro-
ion of sewn items. Seams are divided into
classes:

S--Superposed seam (Superimposed)
LS--Lapped seam
BS--Bound seam (Binding)
FS--Flat seam

eams are further subdivided into types,
gnated by a system of lowercase letters
h indicate the type of the class. These types
consecutively through the alphabet; however,
e there are many variations of seams and
26 letters in the alphabet, multiple lower-
e letters must also be used; for example, a,
, aa, ab, etc.

Most seam types can be produced using either one row or multiple rows of stitches. The number of rows of stitches is indicated by an arabic numeral preceded by a dash; thus, the complete symbol for a simple superposed seam formed with standard stitch type 301 and one row of stitches is specified 301-SSa-1.

SEAM CLASS SS.—In this class of seam the plies of material are superposed and sewn with one or more rows of stitches.

SEAM CLASS BS.—This class of seam is formed by folding a binding strip over the edge of one or more plies of fabric and seaming the strip to the material with one or more rows of stitches.

SEAM CLASS LS.—In this class of seam the plies of material are lapped and seamed with one or more rows of stitches.

SEAM CLASS FS.—This class of seam is formed by seaming the abutted edges of the material together in such a manner that the stitches extend across and cover or tend to cover the edges of the plies joined.

Typical examples of these seams are illustrated in figure 11.4. A careful study of these examples will give the reader an idea of the basic seams and stitchings used in the repair of survival equipment. However, when a specific seam is called for in a drawing or a specification, reference should be made to Federal Standard 751 for the specifications for the seam or stitching to be used.

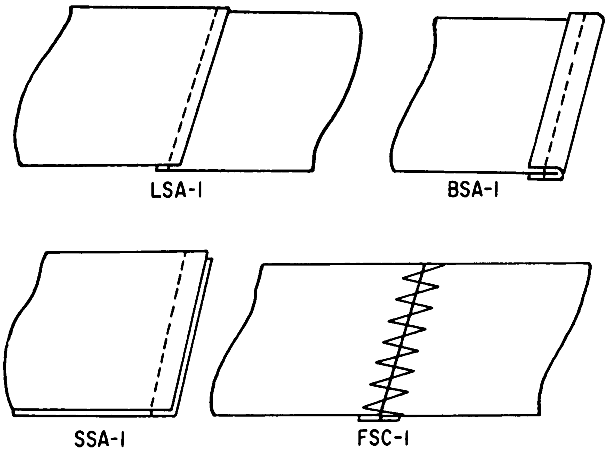


Figure 11-4.—Classes of seams.

Stitchings

Stitching consists of a sequence of stitches for finishing an edge or for ornamental purposes (or both) in preparing parts for assembly. Stitchings are divided into two classes as follows:

OS--Ornamental.
EF--Edge finishing.

These stitchings are illustrated in figure 11-5. Note the difference between these stitchings and the previously mentioned seams. These stitchings are used as finishing touches to a product.

STITCHING CLASS OS.—In this class of stitching a series of stitches are embodied in a material either in a straight line, a curve, or following a design, for ornamental purposes.

STITCHING CLASS EF.—In this class of stitching edge, finishing is accomplished by either (1) stitching a series of stitches at or over the edge of a material (the edge may or may not be folded as specified), or (2) the edge of the material is folded and stitched to the body of the material with a series of stitches.

CHARACTERISTICS OF SEAMS AND STITCHINGS

A properly constructed seam or stitching must have strength, elasticity, durability, security, and a neat appearance. These characteristics must be balanced with the properties of the material to be joined to form the optimum seam. The end use of the item will govern the relative importance of these characteristics, and the selection of the seam or stitching type should be based upon these considerations.

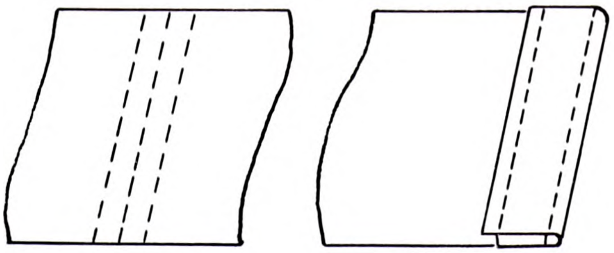

OSA-3
EFA-2

Figure 11-5.—Stitching class OS and EF.

Strength

The strength of a seam or stitching sho equal that of the material it joins in order have balanced construction that will withsta the forces encountered in the use of the item which the seam is a part. The elements affecti the strength of a seam or stitching are:

Stitch type.
Thread strength.
Stitches per inch.
Thread tension.
Seam or stitching type.
Seam efficiency of the material.

Elasticity

The elasticity of a seam or stitching sho be slightly greater than that of the material whi it joins, so that the material will support share of the forces encountered in the end use the sewn item. The elasticity of a seam stitching depends upon:

Stitch type.
Thread elasticity.

Durability

The durability of a seam or stitching depen largely upon its strength and the relation betwe the elasticity of the seam and the elasticity the material. However, in the less elastic, tigh woven, dense materials there is a tendency the plies to "work" or slide on each other. form a durable seam or stitching in su materials, the thread size must be judiciou chosen and the stitches well set to the mater (without undue tension which will unbalance elasticity and cause puckering) to minimi abrasion and wear by contact with outsi agencies.

Security

The security of a seam or stitching depen chiefly upon the stitch type and its susceptibil to become unraveled. The stitch must be w set to the material to prevent snagging whi can cause rupture of the thread and unraveli of certain stitch types.

Appearance

The appearance of a seam or stitching ge erally is governed by the proper relationsh en the size and type of thread, the length of or number of stitches per inch, and the e and weight of the fabric. In addition to elationship, the technique and skill of the g machine operator also governs the ap- nce of the seams and stitchings.

me of the factors which adversely affect ppearance of seams and stitchings are below.

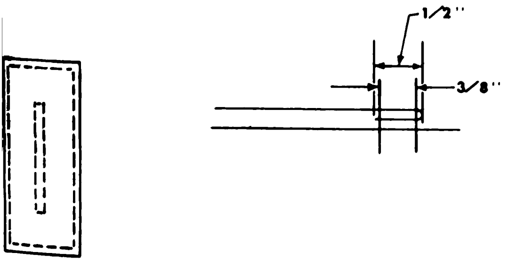
efects in stitchings:
Loose stitches.
Poorly formed stitches.
Crowded stitches.
Tight stitches.
Crooked stitches.
Skipped stitches.

efects in seams and stitching:
Puckers.
Twists.
Pleats.
Raised seams (run-offs).
Felled seams (raw edges exposed).

ATCHING THE PARACHUTE CANOPY

LE PATCH

the hole is 1 inch or less, use a single de patch as diagrammed in figures 11-6, and 11-8. The patch should be large h to leave a margin of at least 1/2 inch nd the borders of the hole (See fig. 11-6.) material used in the repair of canopies be the same as that in the original canopy. applying a single patch, sew two rows of hing around the edges 3/8 inch apart, the row of stitches 1/16 inch from the edge tch. Use a lockstitch with size E nylon d, 8 to 10 stitches per inch, for all sewing tches and other repair work on the canopy.



gure 11-6.—Single outside patch applied to canopy section.

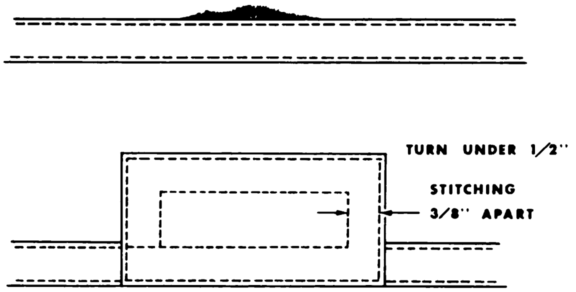


Figure 11-7.—Single outside patch applied to one side of a diagonal seam.

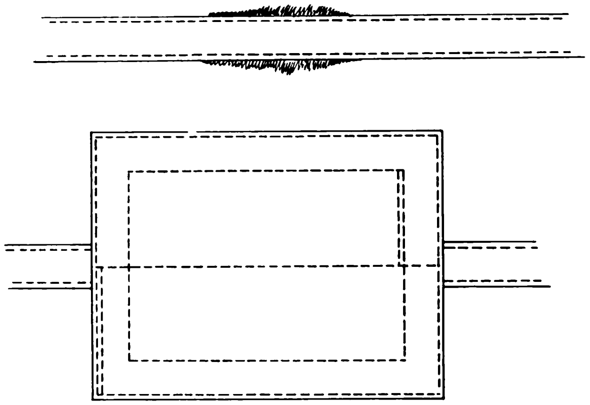


Figure 11-8.—Single outside patch applied to (over) a diagonal seam.

Holes larger than 8 square inches are not patched as a minor repair, but are sent to a major overhaul station for repairs. More than two single patches or one double patch per section are also considered major repairs and must therefore be sent to an overhaul station.

Cut the thread of the stitching as infrequently as possible. When the stitching of a seam has been connected, backstitch for at least 2 1/2 inches on radial seams or hems and 1 1/4 inches on diagonal seams. If a patch is not anchored to a seam or hem, it must be backstitched 1 1/4 inches.

Misplaced or slipped threads in the weave of the material very often may be brushed back into place and a patch will not be required. Whenever several threads are broken they should be reinforced with a patch as shown in figures 11-6, 11-7, and 11-8.

When it is difficult to decide on a definite repair due to an overall deterioration in condition or a damaged canopy, prepare the parachute for major overhaul.

DOUBLE PATCH

When the damaged area is not badly frayed, baseball stitch the tear as shown in figure 11-9. Do not draw the baseball stitches too tight, thereby puckering the area. To produce a smooth finish, maintain just enough tension on the stitches to bring the separated edges together.

Use a double patch for most repairs; that is, one patch inside the canopy and the other patch outside. The inside patch should be the smaller and must be applied first, so that its stitching will be covered by the outside patch. The raw edges of a patch should be turned under 1/2 inch.

Large holes or tears require a double patch, one inside and one outside. After turning under 1/2 inch on all sides, the inside patch should be large enough to allow a 1-inch minimum margin on a 1- to 3-inch puncture; a 1 1/2-inch minimum margin on a hole from 3 to 6 inches; and 2 inches on a hole from 6 to 8 inches. Regardless of the hole size the outside patch must be larger than the inside patch.

Using a soft lead pencil, lightly outline the area to which the patch will be sewn. Be sure to allow the correct minimum margin in relation to the perimeter of the finished or turned under edge of the patch while marking and following the line of the weave around the damaged area. Place the piece of new material with the weave correctly matched, warp for warp, and filler thread for filler thread, over the outlined area. The material is very sheer and the penciled lines may be seen through the patch. Using a pai sharp scissors cut a patch 1/2 inch larger ove than the penciled lines, the extra half being allowed for the hem.

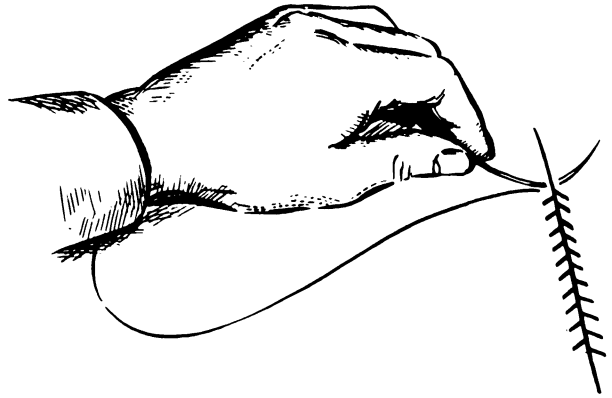


Figure 11-9.—Baseball stitching a tear.

Use the inside patch as a gage when cut the outside patch. Place the inside patch piece of new material. Cut the new mate 1/4 inch larger than the raw-edged perim of the inside patch.

Turn the edges of the inside patch under inch. Baste or press the hem so that it will in place when the patch is being sewn to the side of the canopy. Apply the inside patch, s ing one row of stitches 1/16 inch from the ed

Turn the outside patch over the inside p so that their margins are even all the around. A beginner will do well to baste outside patch in place before attempting to it by machine. Sew the second row of stitc 3/8 inch in from the edge row. This operatio illustrated in figure 11-10.

A badly frayed hole may tend to roll or bu if allowed to remain within a patch and cause wrinkles. Accordingly, the damage m be trimmed to a rectangular shape. If damaged area exceeds 8 inches across widest dimension after trimming, the rep must be considered a major repair and not undertaken locally.

After the material has been trimmed rounded at the corners to prevent tearing, ap a filler patch as shown in figure 11-11. filler patch merely acts as a binder to hold of the separated edges together and preve objectionable wrinkling. After the filler pat apply the inside patch, observing the sa general rules as outlined for marginal allo ances. Then apply the outside patch.

For additional strength, always try to anc one or more sides of the patch to a seam or he NEVER sew through a suspension line. Whene it is feasible to anchor the patch to a seam, dimension of the patch may be extended on applicable side. Figure 11-12 shows the met of anchoring a patch to both a radial an diagonal seam.

REPLACING PARACHUTE COMPONENTS

VENT RING

Broken or damaged vent rings cannot repaired and must be replaced. To replace rubber vent ring, open the hem, remove the ring, insert the new ring, and resew the he

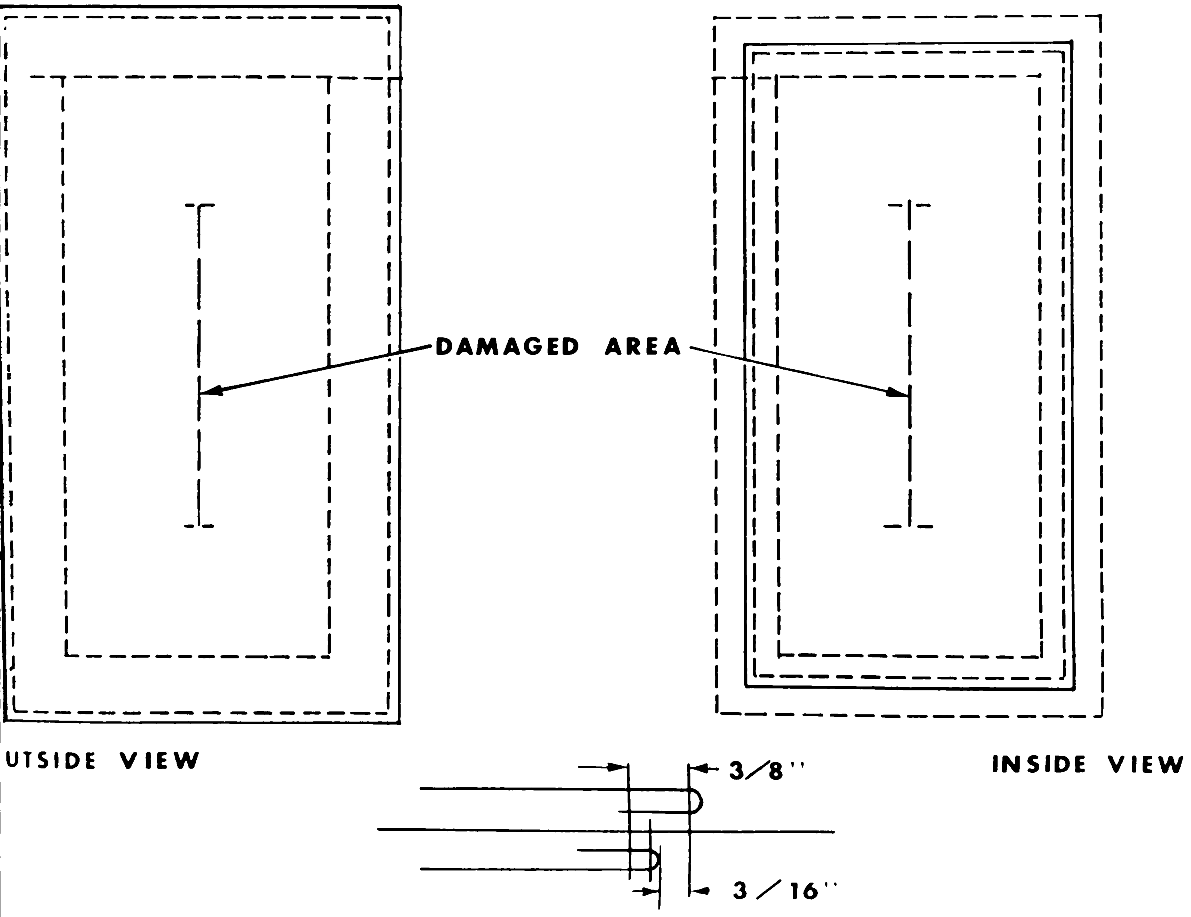


Figure 11-10.—Double patch applied to a canopy section.

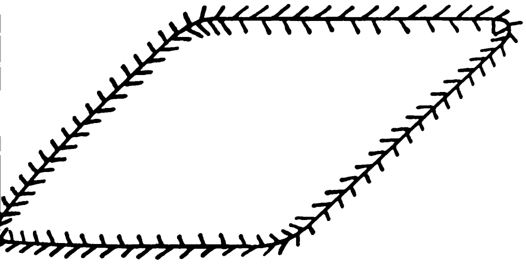


Figure 11-11.—Filler patch applied with baseball stitch.

NESS

arachute harness requiring work other than correction of several (7 or 8) broken or ctive stitches, should be replaced by a new or serviceable harness. The only exception is in the end of the lift web sewing where it is connected to the links and where no defects are permitted. Applicable technical publications should be reviewed for instructions on various valid modifications to be made to existing harnesses to convert them to the latest specifications. Before making any modification, always check to be certain that it has not been canceled or superseded by a later directive.

Harnesses are currently issued with lift webs presewn for the convenience of installing them in the field. Of all stitchings, the connective ones are the most important to security.

PILOT CHUTE

If the pilot chute has deteriorated to such an extent that repairs are impractical and uneconomical, or may impair the efficiency of

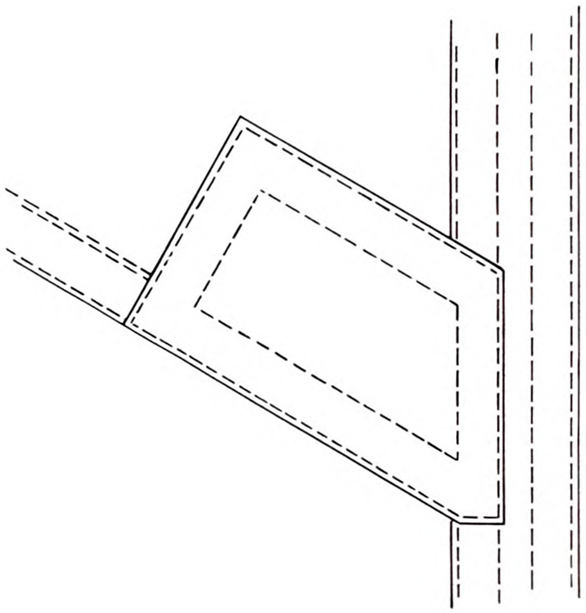


Figure 11-12.—Double patch anchored to a radial and a diagonal seam.

operation, a complete new pilot chute should be substituted. If the spring is weak or defective, or if evidence of general deterioration is observed, the entire pilot chute assembly must be replaced by a new or serviceable one.

Tears, holes, or chafed places in the canopy of the pilot chute should be repaired in accordance with the instructions detailed for repairs to the main canopy.

Replace missing tacking threads which hold the spring in place.

RENEWING THE TIE CORD

When the tie cord has to be replaced and the old tie cord does not correctly separate the suspension lines of the main canopy at the peak, the canopy should be laid out on the packing table with the gore having the nameplate uppermost. Take a position on the left-hand side of the table. Then looking along the table toward the hooks at the end, trace No. 1 suspension line to the point where it emerges from the vent of the canopy. Still looking toward the hooks, count out 14 lines, including No. 1, that emerge successively from the vent and are on the right-hand side (looking down the table) of No. 1 suspension line. This action forms a loop in the suspension lines at the peak the canopy, and it should be temporarily pla over a hook or toggle to prevent its entang ment.

The connector cord is made from a 42-i length of 1/2-inch tubular nylon webbing. S each end of the cord to prevent fraying. L one end of the cord through the separated s pension lines and secure with a bowline hav a 4-inch loop. Tie an overhand knot in bitter end to make the bitter end 1-inch lo Pass the other end through the pilot chute s pension line loop and secure the cord wit bowline knot with a 4-inch loop. After ty an overhand knot, the bitter end will be inches long. The overall length of the c should be 21 1/2 inches.

REINFORCING THE CONTAINER

Reconditioning of the container can be complished with or without a sewing machi Patches, modifications, additions, attachm of cushions or liferaft cases, or other repa of any nature may not be made while the pa chute is in a packed condition. To do so is risk the possibility of accidentally securing of the main parts of the parachute to the c tainer and slowing or possibly preventing proper opening of the parachute in an emerge

Tears and rips in the material should repaired with a single outside patch turned un 1/2 inch at the edges. Corners and edges of container chafed by the metal frame shoul reinforced with 1,800-pound nylon webbing. not use lightweight tape or webbing for purpose.

At the first appearance of acid stains pack, the parachute must be unpacked mediately and the canopy examined for sim damage. The affected portion of the conta must be cut out and an outside patch appl provided the area is not excessively large. entire container must be replaced if the affe area is too large (consistent with good judgm or if the stains are numerous. The canopy sh be inspected and repaired, if necessary, as p viously described.

If the stitches securing the suspension loops to the false bottom have been bro the stitching may be replaced, provided material of the false bottom has not been dama to the extent that the new stitches will not securely. In this case the false bottom be replaced by a new one. If the tape of the pension line loops has been torn, it shoul

ed by a new tape and must not be patched
nded.
piece of 1 1/2-inch nylon tape should be cut
ewed to the false bottom so that the distance
en the rows of stitches as measured on
lse bottom corresponds to the distance
en the rows of stitches on the original
The length of the tape between adjacent
of stitches is 2 5/8 inches for 28-foot
les. When the parachute is being deployed,
of utmost importance that the suspension
be permitted to pay out of the loops freely.
quently, in repairing suspension line loops,
care must be exercised to insure that the
es, heavy stitches, loose thread ends, or
obstructions do not prevent free emergence
e suspension lines. If the loops become
ged to such an extent that they do not
y hold the suspension lines in place, they
be renewed. Original details of manufac-
should be noted and reproduced as closely
ssible.
e two short lengths of webbing (sewn to
ottom of the container) securing the pack
e harness frequently rip loose and must
placed. The container thus damaged does
ffer a secure attachment and must be re-
ced by a patch placed on the inside of the
iner. This reinforcement patch should be
e material and be 2 inches longer and 2
s wider than the webbing.

ACING DEFECTIVE GROMMETS

efective or missing grommets must be
ced, using special dies. When a grommet
orn out of its fastening, it is necessary to
orce the damaged place with a nylon patch,
or light webbing, as the case requires,
e replacing the grommet. The torn parts
be cut away before applying the rein-
ment so that the thickness around the
met will not be increased to such an extent
prevent the locking pins from passing through the holes in the cones. Care must be taken that the inner edges of the grommets are perfectly smooth and rounded so as not to obstruct the operation of the locking pins or retard the action of the grommets in slipping off the cones.

When cones have become corroded, have bent or broken flanges, or are worn where the grommets or end tabs bear, they must be replaced. In replacing cones on the container, sew with double 3-cord nylon thread. (Note the way other cones are sewn and follow the same sewing pattern.) Be sure the ripcord pin holes in the cones are in line with each other and also in line with the direction of ripcord pull.

In replacing loose or lost eyes, sew with double 3-cord nylon thread. (Note the way the other eyes are stitched and follow the same stitching pattern.) It should be noted that at each point of stitching, five turns of the doubled thread are used. It does not matter in which order the stitches are made. Finish the stitching with the thread on the underside of the container and tie off.

CONSTRUCTING THE PARACHUTE CARRYING BAG

Parachutes are shipped and stored in cans; however, in transporting packed parachutes or during the temporary stowage of unpacked parachutes a parachute carrying bag may be required. In the average parachute loft there are therefore many opportunities to construct parachute bags.

The physical dimensions, layout, and cutting may vary somewhat in each loft. Before attempting to make a parachute carrying bag, the novice should consult a senior Parachute Rigger for personal instructions. Templates for various sized bags are available, and the cutting and sewing are routine, the most difficult part of the manufacture being the installation of the slide fastener. This operation is completely described in chapter 12.

CHAPTER 12

FASTENERS

Textile products may be joined by many different methods, depending upon each individual requirement. These methods include sewing (by hand, or by machine), cementing, and the use of various fasteners and fastening devices.

Fasteners have been designed for almost every possible manner in which textile products may be united. Some fasteners act as anchoring and reinforcing points for pockets and corners, while others are snaps, and release their grip when pulled in the proper manner.

The Parachute Rigger must be thoroughly familiar with—and able to repair or renew—each type fastener. These fasteners include:

1. Snap fasteners.
2. Speedy rivets.
3. Grommets.
4. Slide fasteners (zippers).

SNAP FASTENERS

The snap fasteners most commonly used in the manufacture of parachutes and for general utility work in the parachute loft are described in the following paragraphs.

WIRE SPRING CLAMP TYPE FASTENERS

The wire spring clamp type fastener is furnished in two sizes, regular (NAF 312320) and small (NAF 312321). In the parachute loft the wire spring clamp fastener is popularly called DURABLE DOT or DURA DOT. Figure 12-1 shows the parts of the regular wire spring clamp type fastener. In comparison to the regular size, the button of the small wire spring clamp type fastener has a dimension of 17/32 inch, with smaller corresponding parts.

Both the regular and the small wire spring clamp type fasteners are designed with a strong grip, and they will release or separate when pulled in any direction. The regular size
spring clamp is the one most frequently u
It is used in the manufacture of back pads
parachute packs. It is also used on flight clot
where the additional security offered by
THREE-WAY SNAP is not needed. NAF b
prints refer to the parts of this fastene
button, socket, stud, and eyelet.

All parts are plated. Notice the differe
in the studs in figure 12-1. These studs ma
possible to mount the fastener in fabric, w
or metal.

THREE-WAY LOCKING SNAP TYPE FASTENERS (NAF 312326)

The three-way snap is manufactured in
size only, and is used on flight clothing, pa
chute packs, and back pads. (See fig. 12-2.)
fastener will open only when lifted from the
with the dot. It is therefore not used where
quick opening devices or quick releasing ac
is required. For example, the lift web kee
of a seat type parachute are equipped with
regular wire spring clamp fastener, while
two vertical keepers, which hold the shou
straps and the back strap, are fitted with thr
way locking snaps.

CURTAIN TYPE FASTENERS (NAF 49955)

The curtain type fastener (lift-the-dot
manufactured in two sizes, large and sm
The parts of the large lift-the-dot, with var
types of studs, are shown in figure 12-3. Th
fasteners have many uses, especially for t
and boat covers. The small lift-the-dot is
same as the large one, and designed o
smaller scale for use on lighter work wh
the bulkiness and weight of the large lift-
dot are not desired.

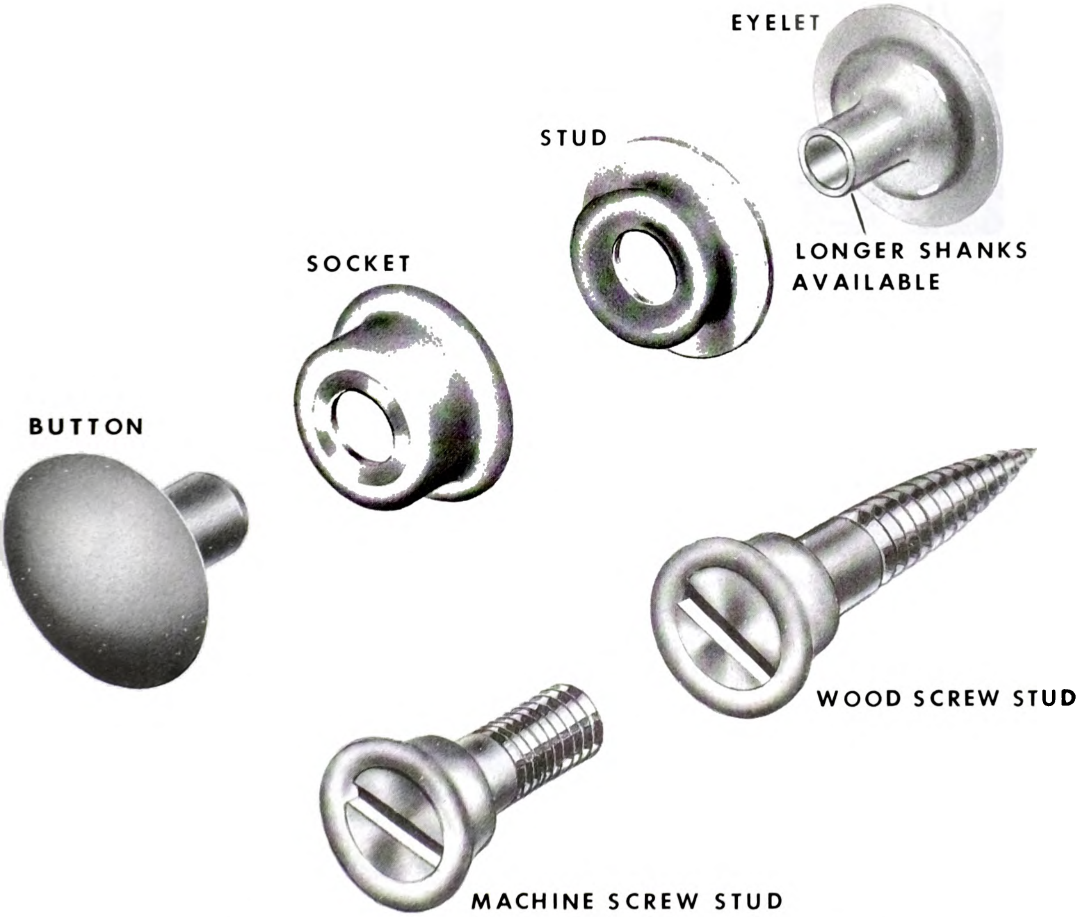


Figure 12-1.—Regular wire spring clamp fastener.

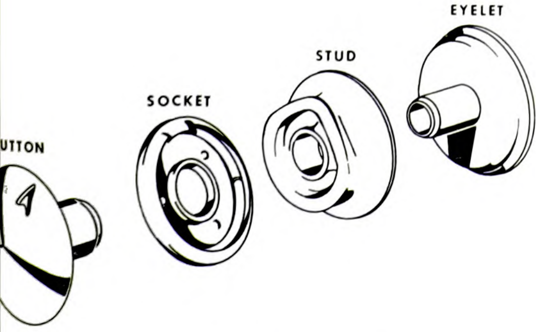


Figure 12-2.—Three-way locking snap type fastener.

GLOVE SNAP TYPE FASTENER
(NAF 312322)

Figure 12-4 illustrates this type fastener, which is generally used on lightweight flight clothing.

INSTALLATION OF SNAP FASTENERS

Figures 12-5 through 12-7 illustrate the methods and tools employed in the installation of the regular wire spring clamp type fastener, large curtain type fastener, and the glove snap type fastener.

Setting Tools

In order to properly install the various types of fasteners used in the loft, it is essential

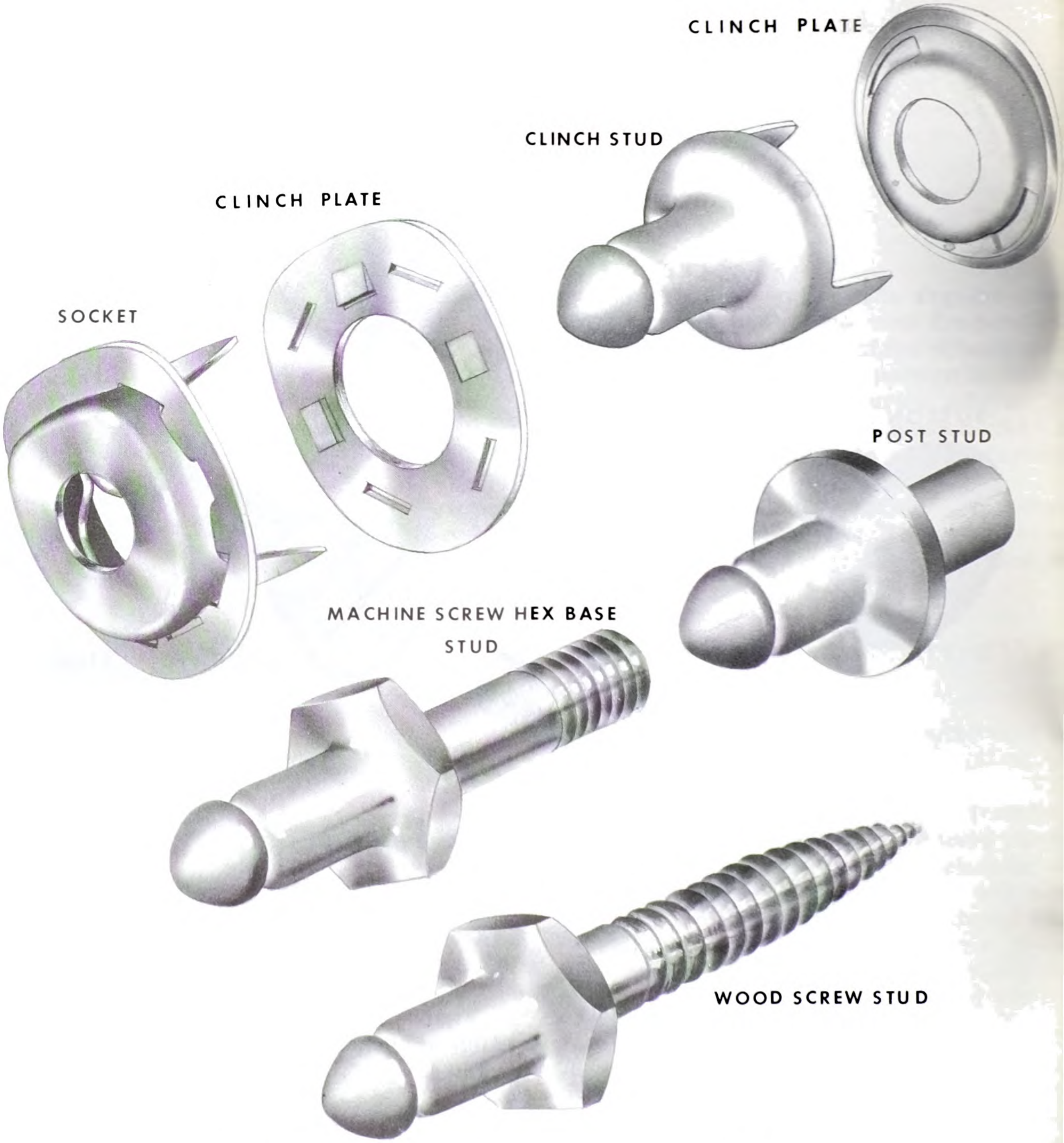


Figure 12-3.—Large curtain type fastener (lift-the-dot).

to use the proper tool (chucks and dies) for the fastener being installed.

A fastener kit which consists of a small cabinet, five drawers, and a supply of assorted fasteners and setting tools is listed in the Federal Stock Catalog, Group 53, Part 8.

The fasteners are replenishable out of ASO stock, but the chucks and dies are not. When a chuck or die is to be replaced, it is orde on a Local Purchase Order.

GROMMETS

The grommet is an eyelet, made of met rubber, or fabric. It is used as a reinforcem

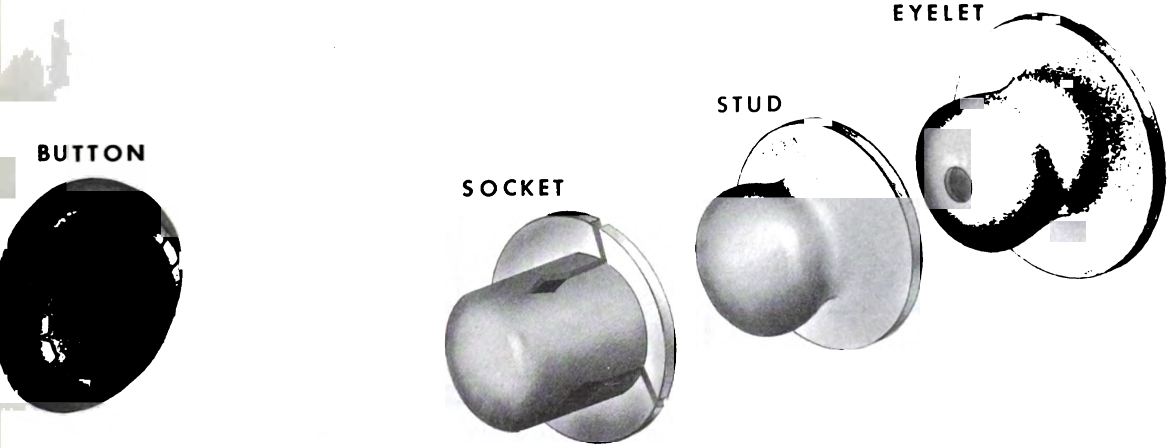


Figure 12-4.—Glove snap type fastener.

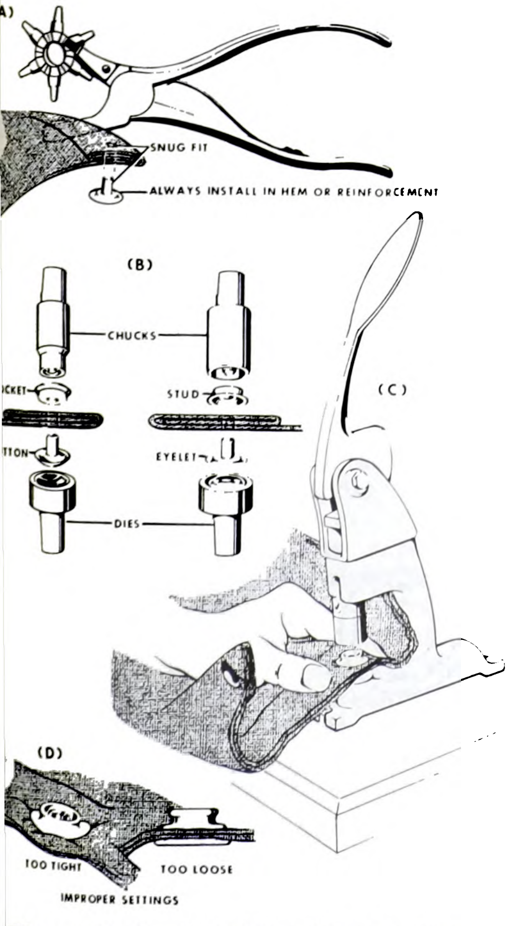


Figure 12-5.—Installing the regular wire spring clamp type fastener.

around a hole or cut, usually on the edge of an item where lacing or similar fastening is required. Examples of these are lacings on tent flaps and locations for securing the side flaps on parachutes.

The types of grommets most commonly found in a parachute loft are the plain grommet and the spur grommet. (See fig. 12-8 (A).) The plain grommet is used in lightweight materials, where there will be very little stress. The spur grommet is designed with teeth in the outer ring of the washer to aid in holding in heavy or loosely woven fabric and in places where considerable stress will be placed on the grommet. Design specifications for grommets are found in Air Force-Navy Aeronautical Standard Drawing AN 230.

The grommet used on parachute side flaps is a plain type, specially manufactured of chrome-plated metal. It is set in the parachute side flaps under a process which fuses the edge of the hole in the material and prevents the circular cut from fraying. This type of grommet is shown in figure 12-8 (B).

Grommets may be set either by hand or by the hand press. The hand press makes a neater job and should be used whenever possible. Figure 12-9 illustrates the hand and the hand press dies and chucks used to set a plain or spur grommet. When setting grommets, the material should be reinforced with a hem or patch before the grommet is set.

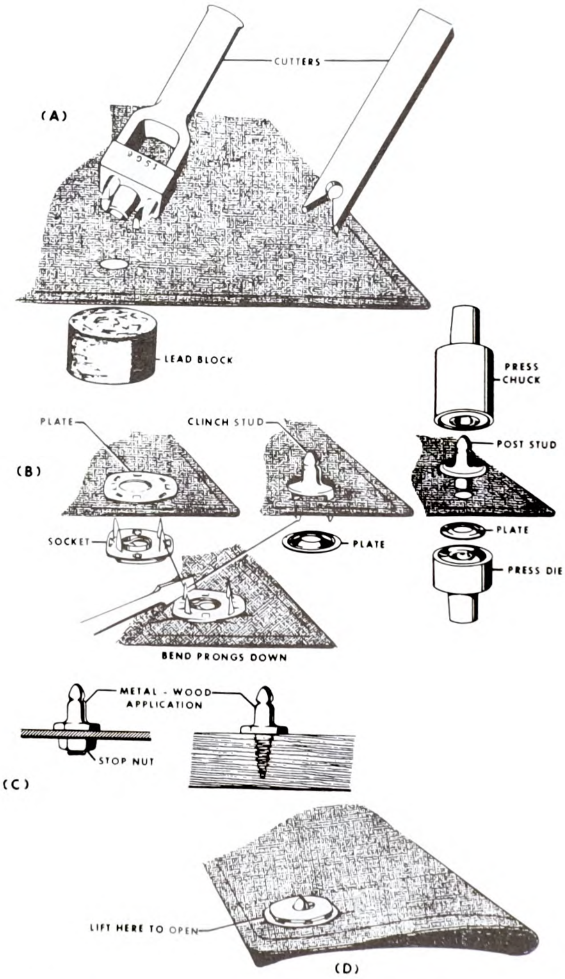


Figure 12-6.—Installing the large curtain type fastener.

SPEEDY RIVETS

Speedy rivets may supplement stitching as an additional reinforcement. One very popular use is in the open corners or pockets of certain types of clothing. They are also used to join two pieces of fabric or to secure a loop in a leather belt.

REMOVING FAULTY FASTENERS

Fasteners may be removed by different methods. The method used depends on the type fastener being removed, the material from which the fastener is being removed, and the person doing the job.

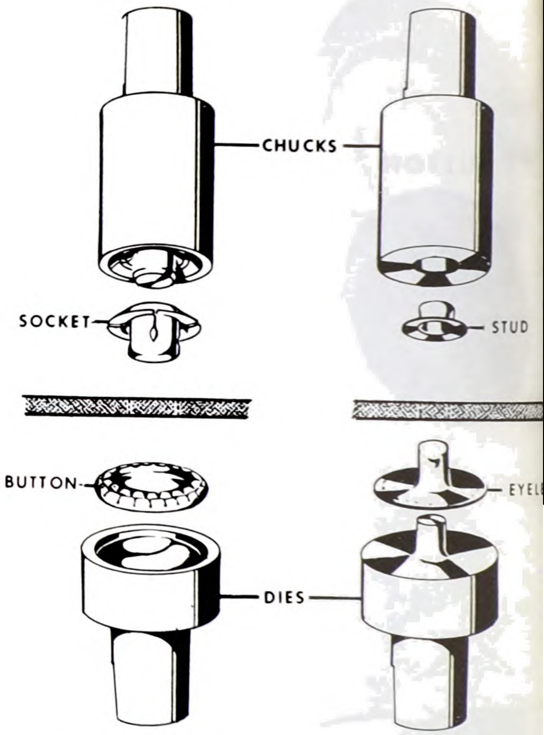


Figure 12-7.—Installing the glove snap type fastener.

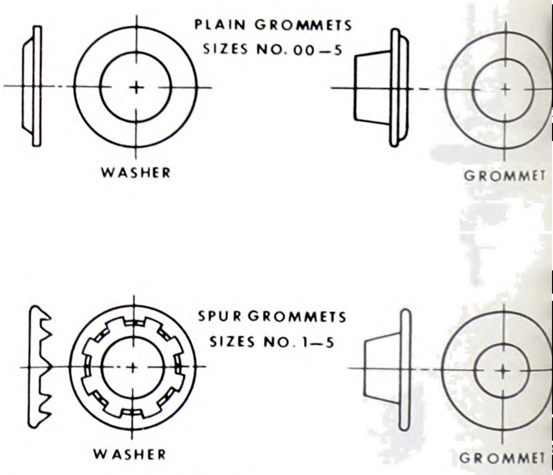


Figure 12-8 (A).—Grommets, plain and spu

SNAP FASTENER REMOVAL

A damaged snap fastener is removed by
ting the shank or post securing the socke
one half and the stud of the other half. A sh
pair of diagonal cutting pliers will do the

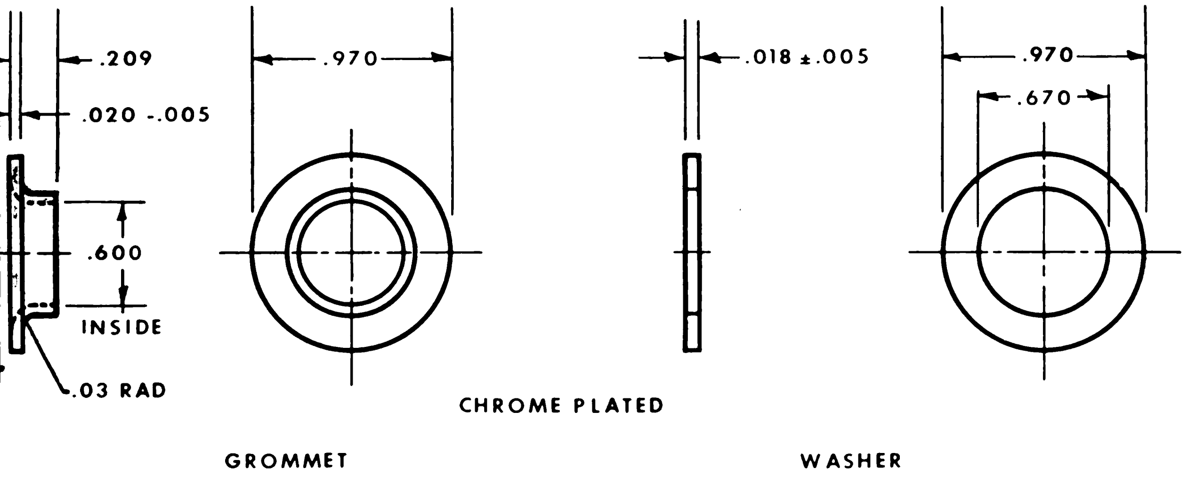


Figure 12-8 (B).—Grommet and washer used on parachute container.

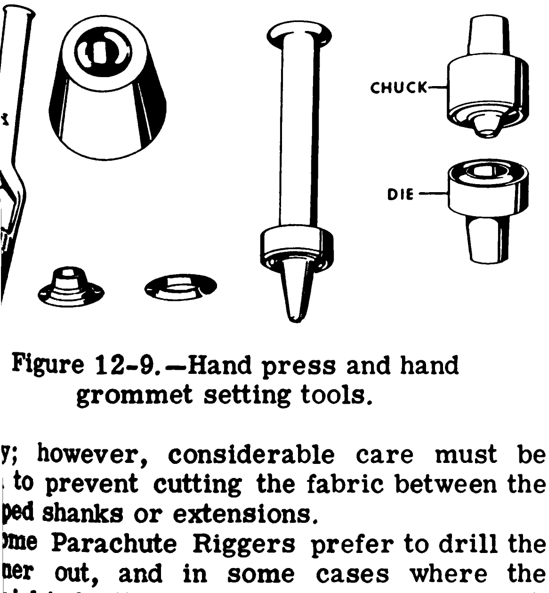


Figure 12-9.—Hand press and hand grommet setting tools.

y; however, considerable care must be to prevent cutting the fabric between the ped shanks or extensions.

me Parachute Riggers prefer to drill the ner out, and in some cases where the rial is brittle or otherwise easily damaged, s the better method. However, the fastener be secured in some manner to prevent it turning and tearing the fabric during the ng.

MMET REMOVAL

ommets are removed by prying the shank from the washer until the shank is un- ped enough to permit the washer to be withdrawn. They may also be removed by cutting the shank with a chisel. This raises the washer enough to permit gripping it with a pair of pliers for removal of the washer.

SPEEDY RIVET REMOVAL

Use a pair of diagonal cutting pliers to remove a speedy rivet. Cut the crimped shank halfway between the two parts, taking care not to damage the fabric.

SLIDE FASTENERS

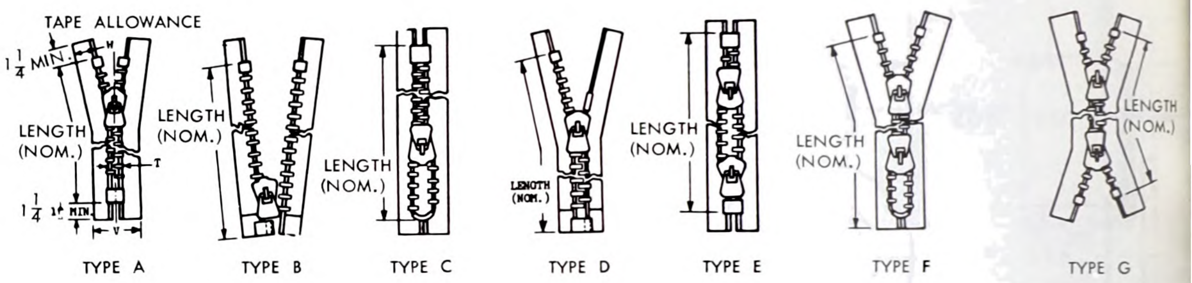
The types of slide fasteners (zippers) used on flight clothing and other items of aviation equipment are shown in figure 12-10. Figure 12-11 shows the parts of a slide fastener.

SLIDE FASTENER CONSTRUCTION

A slide fastener consists of two rows of teeth (hollow cones or scoops) facing each other. When brought together at the proper angle, each tooth is designed to fit within the tooth opposite.

When closed, the slide fastener teeth cannot be parted except through use of the slider which, when moved, displaces the teeth at the proper angle for meshing and unmeshing.

The small clips (stops) at the top and bottom of the slide fastener are designed to prevent



TYPE A - NON-SEPARATING, SINGLE ACTION.
TYPE B - SEPARATING, SINGLE ACTION.
TYPE C - NON-SEPARATING, SINGLE ACTION WITH BRIDGE STOP.
TYPE D - SEPARATING, SINGLE ACTION, QUICK DETACHING.
TYPE E - NON-SEPARATING, DOUBLE ACTION, CENTER OPENING.
TYPE F - NON-SEPARATING, DOUBLE ACTION WITH BRIDGE STOP.
TYPE G - SEPARATING, DOUBLE ACTION, END OPENING.

SIZE 0 - LIGHT SERVICE.
SIZE 1 - LIGHT-MEDIUM SERVICE.
SIZE 2 - MEDIUM SERVICE.
SIZE 3 - MEDIUM HEAVY SERVICE.
SIZE 4 - HEAVY SERVICE.

STYLE S - STANDARD NON-LOCKING.
STYLE L - LOCKING.

Figure 12-10.—Slide fasteners, interlocking.

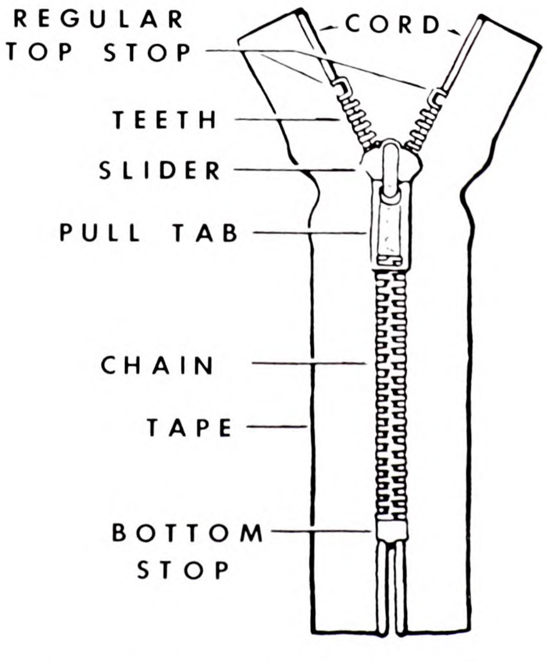


Figure 12-11.—Slide fastener parts.

the slider from running off the track. Separating type slide fasteners do not have a bottom stop, but are equipped with a pin and retainer arrangement to facilitate separating of the slide fastener.

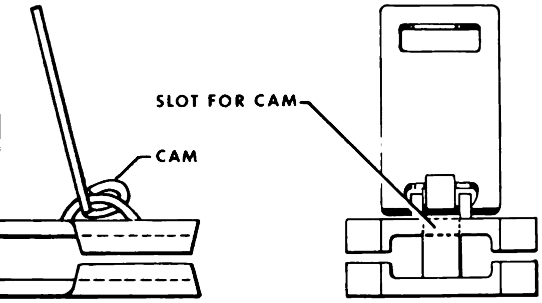
SLIDE FASTENER OPERATION

Ordinary slide fasteners are designed flat, smooth operation, and both hands a required for proper functioning. The chain sho be stretched taut with one hand and the sli worked (without force) with the other.

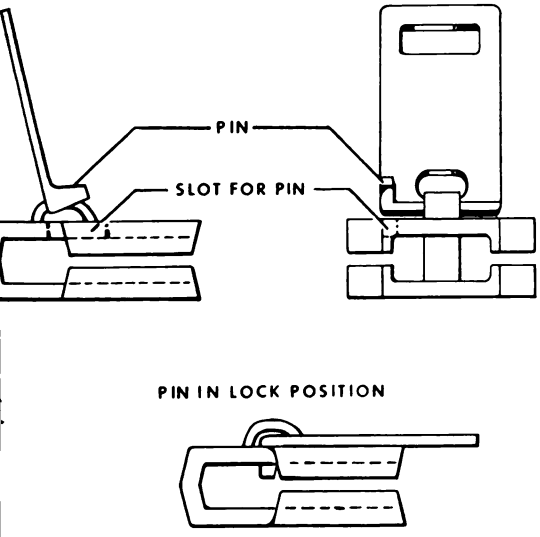
When operating a slide fastener installe a garment made of soft nappy material, or li with wool or fur, do so with care to prev the nap or wool from jamming the slid

Very often grease or oil deposits lodge tween the tiny hollow parts of the teeth accumulate dirt and lint. This causes s operation of the slider. A dirty or gumr chain should be cleaned with an old toothbr or a pipe cleaner saturated with Stoddard solv or other similarly approved cleaning solve After each cleaning, the chain should be lub cated by applying one drop of oil or a sm amount of graphite between the thumb and fo finger and running the chain up and d between the fingers several times.

A brief inspection will determine whethe slider (or pull tab) is the locking or nonlock type. Always be certain that the pull ta lifted at right angles to the slider bef attempting to remove the locking type. relative positions of the pull tabs are show figure 12-12.



SLIDER WITH CAM TYPE LOCK



SLIDER WITH PIN TYPE LOCK

Figure 12-12.—Slide fastener pull tabs.

DE FASTENER TOOLS

addition to common tools such as screw-
rs, pliers, awls, knives, scissors, and
les, a well-equipped slide fastener kit should
ncluded in the parachute loft equipment.
The slide fastener kit (zipper repair kit)
ains all the parts necessary to repair any
or type slide fastener, plus the following
cial tools: end cutters, or nippers, used for
oving stops and teeth; stop-closing pliers,
ally designed to span over the slider and
p the stops in position; and pull-up pliers,
ned to close the slider without a pull tab.
ther handy tool in slide fastener repair is an
with a bent tip. This tool may be used to
se the chain by hand.

SLIDE FASTENER REPAIR

A torn or ripped zipper cord cannot be patched, but should be replaced with a complete new slide fastener. If the cord is damaged near the top or bottom of the slide fastener, and the damaged ends can be cut off to shorten the slide fastener without hampering the usefulness of the garment, an effective repair can be made.

Loose or missing teeth and stops will cause trouble. If teeth or stops are not tightened, they will eventually be lost and tear the cord. In repairing such damage, see that the loose stop is in position (almost touching teeth), then set tightly with stop-closing pliers. Set any loose teeth parallel with the other teeth in the chain, then apply pressure with the stop-closing pliers. If a replacement stop is not available in the repair kit, a soft wire or heavy thread may be used as a temporary stop.

A missing tooth should be repaired by replacing the entire slide fastener. However, in the event that there are no spare fasteners available, a missing tooth may be replaced. This is done by carefully removing the stop from the bottom of the chain, taking off the bottom tooth, replacing the stop, and setting the tooth in place. (Use caution, do not damage the bead of the chain when resetting the tooth.)

Difficulty may be encountered in moving the slider on the chain. This is caused by the jaws of the slider being too tight, or a dirty chain may be the trouble. To loosen the slider, insert a screwdriver between the jaws, and very gently pry them apart until free operation is effected. A dirty chain is cleaned in the manner described in a preceding paragraph.

Should the slider become jammed with fur, wool, or other material, carefully remove such matter with a pin or needle while gently pulling the slider until it is released. If it is so badly jammed that it resists all efforts, remove the slider by carefully bending the jaws apart and returning the jaws to their original position. The slider is then replaced on the chain, as described later.

Most pull tabs have two small projections fitting into slots on each side of the slider. To remove the pull tab, use two pairs of pliers, one on each side, and twist in opposite directions. In replacing pull tabs, this procedure is reversed. Pull tabs furnished as replacements need only to be squeezed onto the slider.

In making repairs to a damaged slider, the slider must be removed. The proper procedure for removing and replacing a slider on the chain following repairs is explained in the following paragraphs.

To remove the slider from the regular type slide fastener (nonseparating), carefully rip the stiches from the BOTTOM of the slide fastener to expose the ends of the tape. Then remove the bottom stop, and slip the slider off the bottom of the chain and entirely off the cords and tape, as shown in figure 12-13. If repair is impossible due to a severed cord, discard the slider in favor of a new one.

To replace the slider on a regular type slide fastener, thread the two bottom cords into the wide end of the slider. Hold the tape so that the bottom teeth are correctly matched, then draw the slider upward until the teeth mesh for several inches. Without allowing the teeth to separate, clamp the bottom stop close to the teeth and over both cords. Replace the tape ends and ripped stitches by hand or by machine.

To remove a damaged slider on a separating type slide fastener, carefully rip the stitches at the TOP of the slide fastener, on the retainer side only, thus exposing the end of the tape. Remove the top stop, slip the slider off the top of the chain, and completely remove it from the cord and tape. Repair or replace the slider.

To replace the slider on a separating type slide fastener, thread the cord on the retainer side into the narrow end of the slider, and allow the slider to slip down the chain. Replace the tape end and ripped stitches by hand or machine.

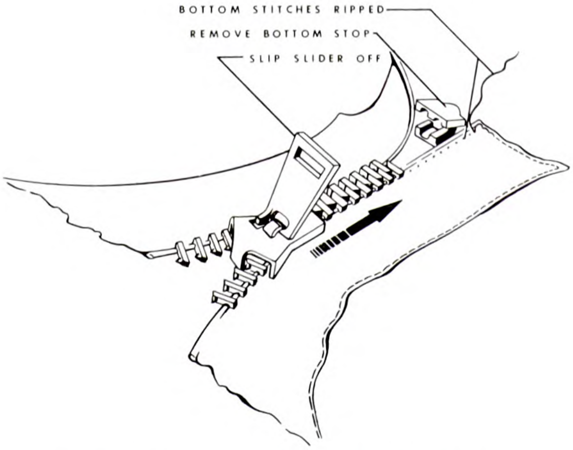


Figure 12-13.—Removing the slider.

To replace the slider on the top of a regul nonseparating type slide fastener with the of pull-up pliers, slip the tool over the bott stop, clamp together, and pull upward. Close entire chain in this manner. Thread the two cords into the narrow end of the slider, hold the teeth meshed until they enter the slid Replace the top stops, tape ends, and rip stitches.

Shortening a Slide Fastener

To shorten a slide fastener, first determ the length required. The chain should be ab 1/2 inch shorter than the opening in the mater or garment. Mark the desired length, measur from the bottom stop upward. Open the chain any point below this mark and cut directly acr the tape about 1 inch above the mark. Cut excess teeth from the marking point to the of the tape, and replace the two stops, crimp them firmly.

Installing a Slide Fastener

The installation of a slide fastener will v with the type of job. Some will be curved, so around corners, and some hidden. The instal tion of a straight slide fastener is illustra in the following paragraphs.

Slide Fastener Presser Foot

In order to install a slide fastener nea and easier, a slide fastener presser foot sho be used on the sewing machine. The sl fastener presser foot will serve not only a guide for a neat row of stitches, but will a prevent the foot from riding up on the cha

The sewing machine manufacturer can sup a regular slide fastener presser foot (right left) for any sewing machine, or one can made locally. File or grind the left side of old presser foot to permit sewing to within inch of the chain.

Fabrication

When sewing, always stretch the slide fa tener and not the material, as this makes flatter and neater job.

A simple method of installing a slide fa tener when making a bag or cover with t closed ends follows: Lay the piece of mater right side down, and place the slide fastener ri down on top of the material where the ng is to be located. Sew a row of stitches letely around the outer edge of the tape, own in figure 12-14.

ırn the material over. Then by feeling with ɔints of a pair of scissors, cut the material tly down the center of the chain and cut a each end, as shown in figure 12-15. ırn the edges of the material under, thus ing the chain. Allow sufficient space be- ı the chain and the folded edge of the rial, to prevent the slider from rubbing dge of the hems. Cutting the V at each end e chain permits the sewing of neat, square ers. (See fig. 12-16.)

CUREMENT OF SLIDE FASTENERS

he nonseparating slide fastener tape chain is ed in bulk rolls of 10-foot minimum lengths izes 1 and 3. They are interlocked while ed in stock and will remain interlocked shipped. The unit of issue is in feet.

he separating slide fasteners (with re- rs and separating pins attached) are stocked ize 3 only, and in lengths of 24, 48, 72, 108 inches. Unit of issue is EACH. Neces- stops and sliders are stocked in bulk. the style L, locking, nonreversible, single slider is furnished.

ize 1 medium service and size 3 extra y service fasteners are the only two sizes ock.

ctivities should specify the brand of chain which stops and sliders are required. (Talon, wn, or any other make.)

lide fasteners in stock will be supplied in nearest length ordered. When received, the n should be cut to the desired length; stops be salvaged and reused on the cut chain.

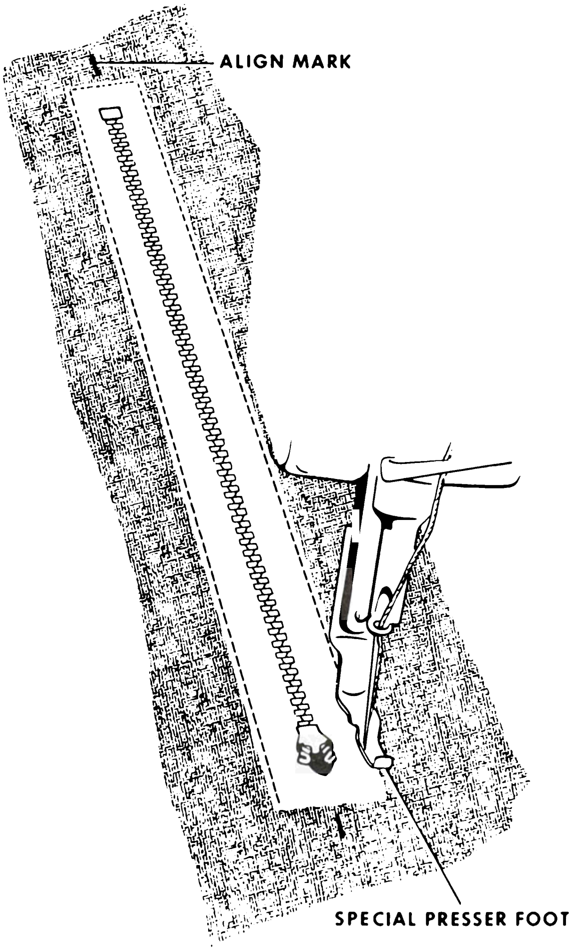


Figure 12-14.—Installation of a slide fastener. Step 1.

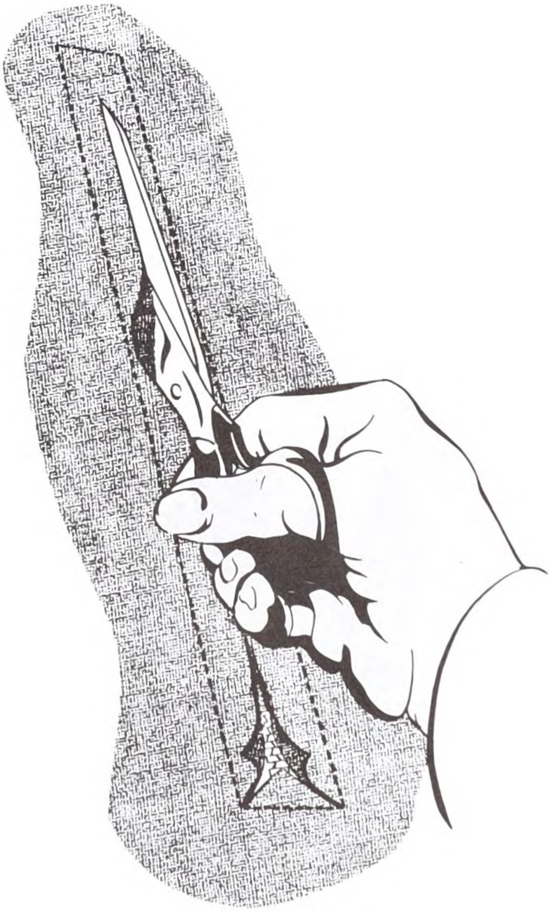


Figure 12-15.—Installation of a slide fastener. Step 2.

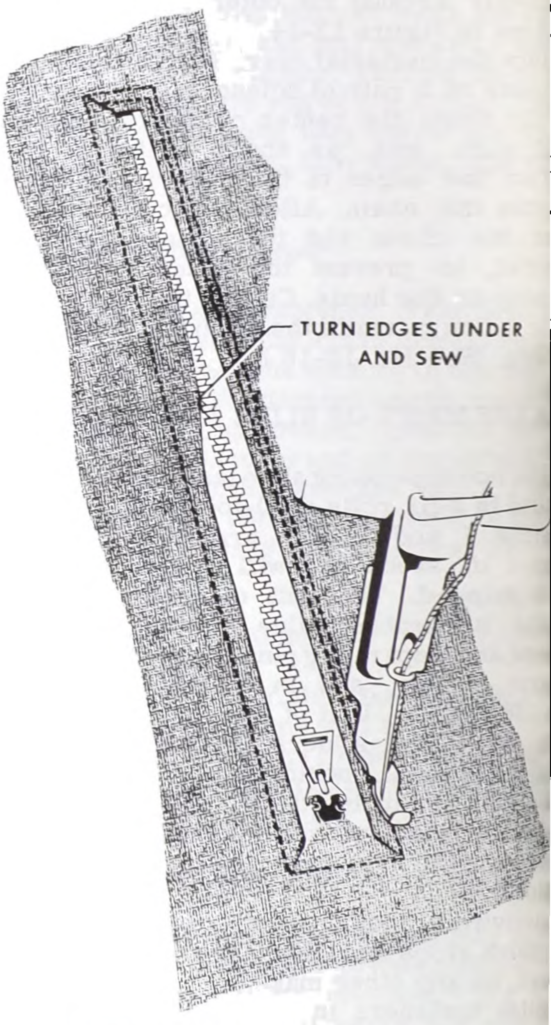

TURN EDGES UNDER AND SEW

Figure 12-16.—Installation of a slide fastener. Step 3.

CHAPTER 13

PROTECTIVE HELMETS AND OXYGEN MASKS

PROTECTIVE HELMETS

he wearing of protective helmets during
ff, flight, and landing by pilots and air-
men is required in designated types of
aft. Helmets are constructed to distribute
ct forces over the entire head and to
rb much of these forces so that a mini-
amount of shock reaches the skull and
.

elmets have long been accepted items for
protection in athletics and certain hazardous
stries. They have also been in long use in
l aviation. In early days, aviation helmets
of the same type as motor cyclists' helmets,
ned primarily to give protection against
last. Later, they were made similar to
ll helmets with the idea of protecting
t impact. However, with advances in
ft design and speed, the need grew for
ets that would simultaneously provide many
s of protection. The advent of high-speed jet
raft, in particular, emphasized the impor-
e of protective helmets that would effectively
ce the likehood of concussion or uncon-
usness due to in-flight buffeting, crashing,
eat ejection.

ne of the main differences between the air-
t protective helmet and the athletic type
et is in the constituent materials. The
tion crewman's helmet is designed more for
rbing energy than for deflecting energy.
s, in case of a very heavy blow, the helmet
absorb much of the force of this blow by
ial destruction of the material of the helmet
er than by passing the force on to the head.
s is often important in preventing serious or
l head injuries, as demonstrated in a number
ases in which the great forces involved
aged the helmets but left the wearers with-
serious injury. Another way in which the
net prevents or reduces injury is by spread-
the force of the blow over a large area of the skull instead of letting it be concentrated at the point of impact.

TYPE H-3 PROTECTIVE HELMET

The H-3 protective helmet consists of a cloth underhelmet (liner) and a rigid protective shell. (See fig. 13-1.) The liner fits snugly, provides an attachment for the oxygen mask, and supports and positions the radio communication earphones. Figure 13-2 illustrates the fully equipped H-3 protective helmet assembly.

The liner is available in five sizes—small, medium, intermediate, large, and extra large. The size of the liner can be adjusted by means of a nylon strap and buckle that is sewn on the back of the liner.

The oxygen mask is attached to the cheek flap by means of two Pull-the-Dot snap fasteners. The matching female fasteners on the mask have a dot on their outside surface, and unlock in one direction when pulled apart away from the dot. This provides a positive locking action, Insuring the pilot of keeping the oxygen mask, even if he loses the protective helmet during a high-altitude bailout.

The earcups on the liner have been designed to accommodate earphone assemblies. The earcups are also designed to provide some sound attenuation against ambient noise, and to increase radio reception.

One male snap fastener is located on each side of the shell exterior between the two buckles for attaching the goggles to the shell. In addition, a microphone bracket is secured to the right side of the shell exterior for attaching a boom type microphone. This microphone is very fragile and should be handled with care.

The rigid protective shell is composed of laminated and mat Fiberglas compounded with a polyester resin. The rigidity of the shell is increased by reinforcing ridges located on its outer surface. A black rubber beading around the

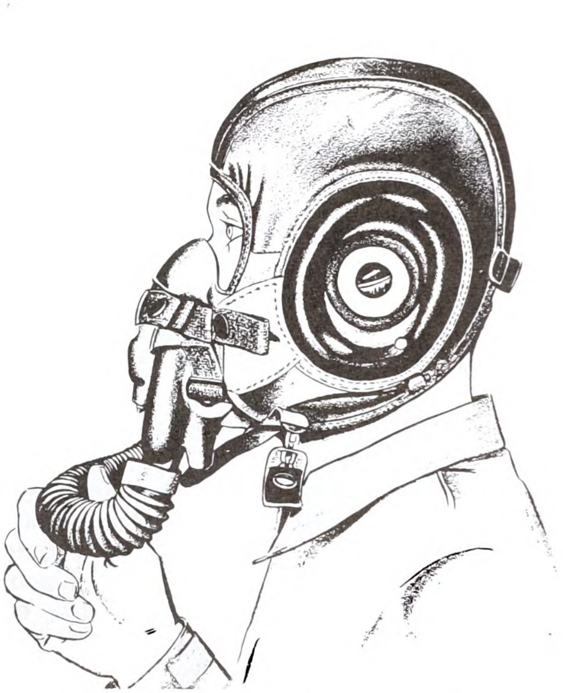


Figure 13-1.—Cloth underhelmet (liner).

borders of the shell protects the wearer from sharp edges.

The protective shell is available in four sizes—small, medium, large, and extra large. Tests have shown that the Navy's protective helmets will withstand an impact force in excess of 64 foot-pounds and a static load in excess of 600 pounds without structural failure.

WARNING: The wearer of the protective helmet should be instructed not to place any unauthorized metal objects on the shell. Under crash conditions, these additional metals may be driven into the head as secondary missiles.

Additional protection against injury from impact is provided by energy-absorbing padding within the helmet shell, consisting of four pieces of Royalite cemented directly to the shell interior and small pieces of leather-covered foam rubber placed circumferentially between the adjustable headband and the shell. Deformation of all parts of the padding under impact absorbs the impact energy and distributes the forces, thereby decreasing the injury potential of a blow delivered to the helmet shell.

The shell is fitted to the head by means of a sling suspension having an adjustable headband. Buckles for adjustment of the headband are located on both sides of the shell exterior just above the ear level. The most protection aga impact is obtained when the headband is adju to fit snugly with maximum spacing between front headband and helmet shell. Pilots and crewmen should be instructed in the pro procedure for adjusting the slings very ca fully prior to use.

A modification on the H-3 consists of ins ling stabilizing straps and chinstrap interc nections to provide the additional stability nee when catapulting, making arrested landings, in maneuvers involving high "g" acceleratio The attaching of the straps to the liner outer shell on protective helmets that have already been made by the manufacturer illustrated in figure 13-3.

The wearer need not separate the assem after it is modified since it can be utilized one-piece helmet. The modified cloth und helmet (liner) should not be worn by itself si no protection is afforded, and any attempt anchor the free ends of the webbing by additio male fasteners on the liner may increase possibility of serious head injury during imp

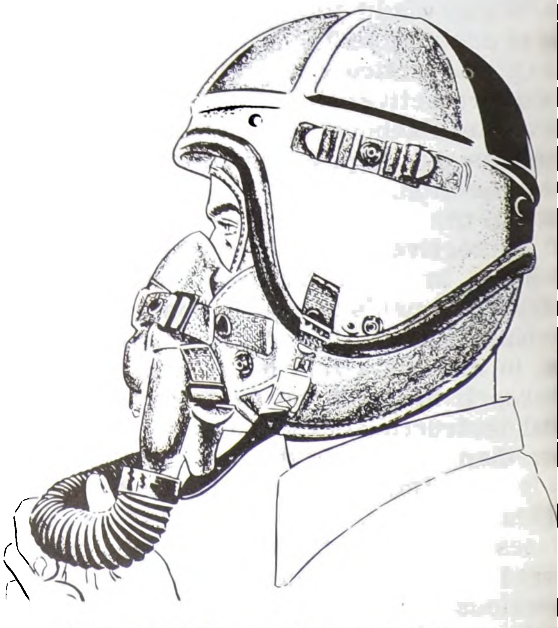


Figure 13-2.—Fully equipped H-3 protective helmet.

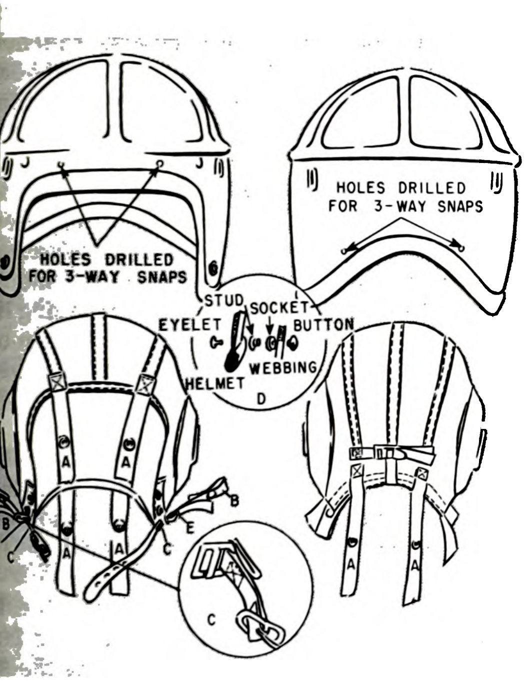


Figure 13-3.—Attachment of stabilizing straps.

E H-4 PROTECTIVE HELMET

The H-4 helmet is basically the same as the with the following exceptions:

. The headband is fixed in front and is not stable.

. The front of the helmet has been lowered increased protection and stability.

. The center panel of the H-4 liner is made ylon mesh for coolness.

. The stability of the H-4 protective helmet n improvement over the H-3; however, the may be modified in the same way as the when necessary.

The H-3 and H-4 helmets are used primarily rewmen in multiplace aircraft. They are no er under procurement; and when replace- t is necessary, they will be replaced by er the SPH-2, the BPH-2, or one of the APH s, whichever is applicable.

E SPH-1 PROTECTIVE HELMET

The SPH-1 helmet is the Navy standard e-attenuating protective helmet. This helmet ised by flight crews of helicopter and VS adrons. It is constructed differently from the above mentioned helmets and is described in detail in the following paragraphs.

The SPH-1 helicopter helmet consists of two major assemblies, each of which is drawn from supply as a separate item. The outer shell assembly, shown in figure 13-4, is available in 3 sizes—small, medium, and large. The outer shell assembly is furnished complete with neoprene foam edgeroll, cloth cover (used with the inner foam liner), microphone plug holder, and chinstrap assembly. The chinstrap assembly consists of the strap, chin cup, and microphone adapter. Each outer shell assembly is also furnished with a separate strip of sizing material.

The other major assembly is the inner foam liner, available in 7 sizes. This assembly is designed to be easily attached to the outer shell by snap fasteners, thus facilitating removal for cleaning.

The outer shell affords impact and penetration protection. It is molded from an epoxy impregnated Fiberglas. An epoxy resin type paint applied to the outer surface of the shell affords a smooth, tough surface which resists chipping and cracking under normal usage.

The edgeroll is a molded neoprene foam edging, installed around the opening of the outer shell. It affords a seal that aids in sound attenuation.

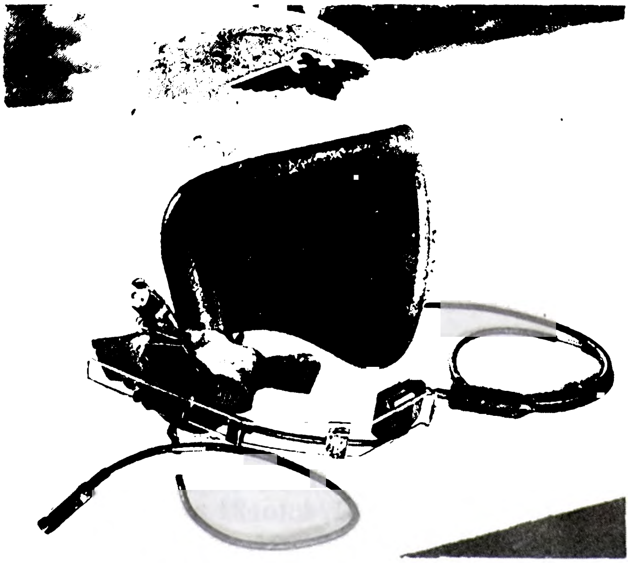


Figure 13-4.—SPH-1 outer shell assembly.

The cloth liner is available in three sizes—small, medium, and large. Each liner contains two fasteners located in the front and the back. These snaps provide an attachment to the inner foam liner. The cloth liner is fabricated from a double stitched preshrunk rayon-gabardine material. This cloth liner is easily removed from the inner foam liner for washing.

The chinstrap assembly is attached to the outer shell with Pull-the-Dot fasteners. The strap is fabricated from nylon material and incorporates a chin cup to improve the helmet retention and comfort. There is also a microphone adapter attached to the chin cup for installation of a microphone.

The inner foam liner is molded from diisocyanate foam material and is designed to attenuate external sounds. The liner is molded to form fit the shell interior. Energy-absorbing material has been inserted in the center section of the inner liner to attenuate impact forces and distribute these forces over a wide area.

The thin earphones are installed within cavities built into the inner foam liner, eliminating the need for separate earcups. A strip of sizing material (24 x 2) is furnished for size adjustments not provided by the inner liner.

The communications equipment is not furnished with the helmet. It should be ordered separately at the time the helmet and liner are ordered. A type M-3A/A microphone is used and is installed on the adapter provided on the chin cup. A type H-87A/U earphone assembly should be installed in the cavities provided in the inner foam liner. The communication cord is routed through the grommet provided on the rear left side of the helmet. The microphone plug holder slips under the grommet provided for the earphone cord outlet, in the lower left rear position of the outer shell. This holder is provided to prevent the microphone plug from hanging loosely when not in use.

Fitting Technique

By selecting the proper combination of the various sizes of outer shell and inner foam liners available, it is possible to provide a good fit for any individual requiring a hat size ranging from 6 3/4 to 7 5/8 or having a head circumference from 21 1/4 to 24 inches. Normal head height variations are compensated for within the soft foam inner liner.

The wearer should first don the helmet with the size that corresponds to his hat size. The proper method for donning the helmet is to h the individual place the thumbs on the ins ear portion and pull outward on the hel inserting the forehead in the area between two thumbs. Donning of the helmet is compl by rolling the helmet backward until it is p tioned to the individual's satisfaction.

A good fitting consists of a snug seal at cheek, forehead, and nape of the neck. Rec mended sizes will not prove completely adequ in all cases, and further attempts should made to attain proper fit by interchanging lin and outer shells. Fittings which result in un pressure and discomfort after a short perio wear must be corrected.

FOREHEAD AREA.—For correcting the of the forehead area, substitute the next lar size liner or smaller size liner, depending u whether the forehead slopes in or out.

CHEEKBONE AREA.—To correct the fi the cheekbone area, substitute the next lar or smaller size shell, either utilizing the sa inner foam liner or the smallest liner called within the next shell size range of line

EAR CAVITIES.—Since the helmet liner cavity is basically designed to eliminate pr sure on the ears for standard head sizes person with a small head width, measured fr ear to ear, may not be able to hear prope or obtain adequate sound attenuation. To corr this, cut a small square of the sizing mate furnished with the assembly. Cement this ma rial to the shell at the ear cavity. This will m the imbedded earphones closer to the ea

Procedure for Removal and Replacement of Inner Foam Liner

To remove the inner foam liner, lay helmet on the lap or table. Facing the bott of the helmet, insert the hand between farthest side of the inner liner and the sh to any point on the head crown surface of liner. Then press that side in toward the cen of the helmet and pull the hand and liner with a rolling motion toward the opposite s and rear of the shell.

To replace the inner foam liner, grasp b extremities of the liner ear cavities and pre them together. Insert the liner sideways from rear of the shell with the front of the lin ting straight down. After the liner passes the cavity of the shell, release the handhold and asp the liner at its back center with the rs between the liner and shell. Then, push iner down and forward to the front center e shell.

E SPH-2 PROTECTIVE HELMET

he SPH-2 is an improved version of the 1. It is issued in 3 sizes of outer shell loth inner liners, and 7 sponge inner liners ear seal assembly. The cloth inner liners the ear seal assemblies are attached to the r shell with fastener tape.

E APH-5 PILOT'S TECTIVE HELMET

The APH-5 protective helmet is shown in re 13-5. The helmet is available in large and ium sizes. The complete unit consists of an shell, energy-attenuating liner, sizing integrated visor, earcup assemblies, com- cation cord, oxygen mask retention devices, strap, and adjustable chinstrap. Furnished the unit is an envelope containing four shims two screws for horizontal adjustment of the up assemblies. A sizing instrument, to be ed in fitting the helmet properly, is issued each new helmet.

he outer shell provides force-distribution enetration-resisting properties. The outer is molded from glass fabric and a poly- resin.

he liners are provided to absorb or dissi- impact energy and thus minimize skull cture or brain injury, or both. The three tions of the liner are made of cellular ystyrene sheets and molded to fit closely the de contours of the outer shell.

The sizing pads permit fitting of the APH-5 met to an individual's head contour with the er balance between stability and comfort. sizing pads are supplied in three basic igurations—back, crown, and front; also in basic thicknesses—thin and thick. The pads miniature size and leather covered, reducing discomfort that could result from internal in the helmet.

The integrated visor provides protection sunglare, windblast, dust, foreign particles, flash fires. It has excellent optical proper- and resistance to cracking, and when in the position is protected from damage by a housing. The housing is molded from a glass fabric and a polyester resin, similar to the outer shell.

Two colors of visors—clear and tinted—are available for use in the helmet assembly. The tinted visor is currently supplied in various densities. This range of densities satisfies various requirements for specific visual conditions and/or individual preferences.

The relative darkness or degree of visible light transmittance is indicated by white markings on the inside edge of the visor. This marking can be seen more readily by removing the visor from the housing. Table 13-1 shows the markings and the percentage of light transmittance.

Table 13-1.—Visor marking and percentage of light transmittance.

Marking	Percentage of light transmittance
XD1	8 to 10 percent (medium dark)
XXD	6 to 8 percent (dark)
XXX	5 to 6 percent (very dark)
*D	10 to 20 percent
*XD	Under 10 percent

*In the initial quantity of helmets issued to the fleet, these two types of tinted visors were installed.

Due to manufacturing processes, it is impractical to control transmission of the various filter visors produced. In view of this practice, medium and large size visors with varying percentages of light transmittance are carried in the supply system under a single stock number. It is recommended that personnel check lenses at the squadron level, obtaining individual preferences before procuring from supply.

The earcup assemblies contain the earphones and improve radio reception by providing attenuation of outside noise. Each assembly consists of a phone housing of cellular polystyrene, an ear cushion assembly composed of a soft neoprene foam rubber body, and a diisocyanate foam face cushion. Later models have

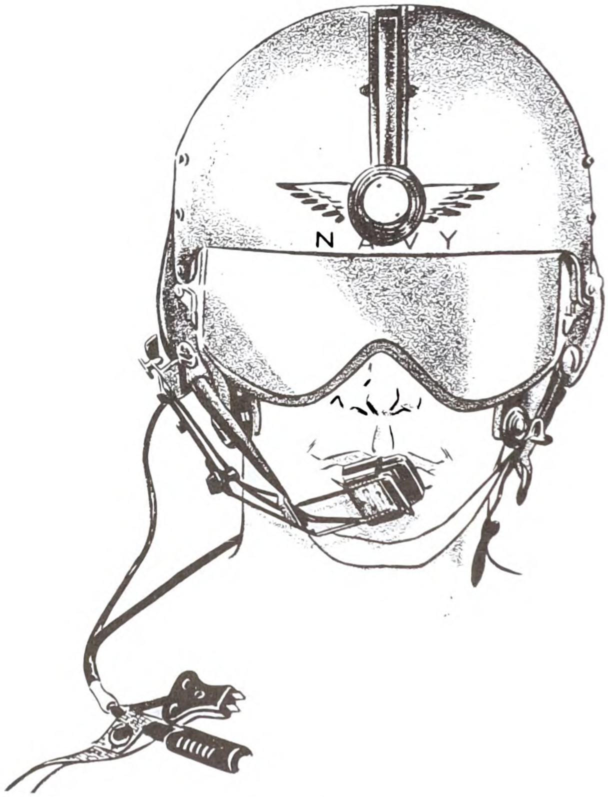


Figure 13-5.—Type APH-5 pilot's protective helmet.

soft leather covered cushions. If the earcup assemblies are loose and need adjustment, the four shims and two screws contained in the envelope should be utilized to accomplish the lateral adjustment. Proper fit of the earcup is necessary for proper radio reception. The earcups have been designed with a large ear cavity to minimize the possibility of pressure discomfort of the ear. A vinyl film washer is inserted between the earcup and the shell to increase stability of the earcup assembly in the event that the shims are not necessary for lateral adjustment.

The communication cord is designed to provide electrical connections between the earphones and the aircraft radio facilities. The molded junction block connecting the four earphone leads to the cord is located in the back left center of the middle section of the cellular polystyrene energy-absorbing material.

The installation of the boom type micr phone, when desired, should be accomplish as follows:

Pre-position the boom mike assembly ont side of the helmet. Swing the boom through full arc to determine the best position f attachment of the mounting bracket. Then scri the intended position of the bracket mounti holes, drill holes accordingly, and attach. T position will vary with the face shape and pe sonal preference. Boom type microphones a not provided with the helmet assembly and mu be ordered individually.

Type H-87A/U earphones are installed the cellular polystyrene earcups of the e cushion assembly. Each earphone is connect to the two wires leading out of each side of t molded junction block of the communication co

Fitting Technique

To properly use the sizing instrument a fit the APH-5 helmet for optimum comfort a stability, the following instructions should applied:

Determine the head length. The helmet si and liner thickness are indicated on the hor zontal bar. Determine the head breadth. Wh the head length dimensions provide a choi between two sizes of helmets, the head bread should be the factor in determining the prop size. If the head breadth is over 6 inches, u the large size helmet with all thick line (sizing pads). If the head breadth is under inches, use the medium helmet with all th liners.

After the liners have been inserted, have t pilot don the helmet. The proper way to don t helmet is to place the thumbs over the e cushions, and pull outward on the helmet; inse the forehead in the area between the thumb and complete the donning by rolling the helm backward until it is positioned satisfactoril

COMFORT.—If the helmet is not comfortab to the pilot, make the following suggest revisions:

If a thick liner is used in the area affecte substitute a liner of lesser thickness. If t pressure point remains, choose the next larg size helmet and use the thick liners in t unaffected area and the thin liners in t affected area. Earcups can be modified slight by filing a portion of the outer edge of t attaching side away to relieve pressure poin and improve comfort.

TABILITY.—To obtain maximum stability, a fit is required. It is possible that stability been sacrificed for comfort in relieving the sure points. Proper stability can be deter- d by vigorously shaking the head. Keep in that the pilot must be the judge in deter- ng the correct balance between comfort and lity of the helmet.

fter the fitting has been accomplished and cient flights have been made to determine acy of fit, the unused sizing pads, shims, sizing instruments should be returned to the l supply for reissue. In addition, clear visors are not being used should be returned to ly for reissue.

tenance

There is a minimum amount of maintenance the helmet, since the pilot keeps it in his session. On occasions, maintenance such as menting loose sizing pads, liners, etc., may ecessary. When not in use, the helmet should ys be kept in the bag provided.

CHANGING THE VISOR.—Changing the visor e APH-5 helmet is a simple task, but the wing procedure should be followed:

Place the visor in the down position and re- e the locking screw from the visor lock (the ing screw has a left-hand thread), then ove the adjustment knob (right-hand thread) clamping washer. Turn the key assembly 90 ees and lift out of the track slot, then remove r from visor housing.

To insert a visor replacement, this pro- ure is reversed.

CLEANING THE VISORS.—The following pro- re for cleaning visors is recommended: Wash the visor with mild soap and water, a clean soft cloth. If the visor is still d or if it is necessary to remove minor tches, use polish. Specification MIL-C- 7B polish is used on acrylic plastic. To serve the surface, use polishing wax for the l application.

REPLACEMENT OF ELECTRONIC EQUIP- NT.—To replace the communication cord, ove the ear cushion assembly from the hel- by removing the screw on each side of the r shell. The earphones can be disconnected n the wiring harness after the ear cushion per has been removed from the polystyrene housing. At this point, release the screw engaging the clip and junction plate at the rear portion of the helmet for complete removal of the communication cord.

To replace the communications equipment, reverse the above procedure.

Installation of the Hardman Oxygen Mask Retention Kit

The Hardman 3740 oxygen mask retention kit is provided for attaching the A-13A oxygen mask to the APH-5 pilot's protective helmet. Installation of this kit affords greater retention of the mask and helmet during high-altitude/high-speed bailouts. Instructions for installation are provided with each kit.

OXYGEN MASK AND HELMET MODIFICATION.—Before attempting to install the retention kit, make certain that the oxygen mask and the kit are of the same size. Remove all the straps and the metal yoke from the mask. Cut off the protruding rubber strap attachment loops from the mask. This is done by cutting flush at the mask surface with a sharp knife or a pair of end cutters. Remove the lip strap supporting the sealing flanges of the mask. (The removal of the lip strap is optional for comfort.) Place the stripped oxygen mask in the retainer shield assembly.

Remove the earphone assembly, the oxygen mask leather tabs, and chinstrap from the helmet.

ADJUSTMENT TO PERSONNEL.—Locate a point 1 1/8 to 1 1/4 inch below the end of the visor track and 1 to 1 1/8 inch back of the forward edge of the helmet, as shown in figure 13-6. Drill a 3/16-inch diameter hole at this location.

Place the backing plate on the inside of the helmet and the latch assembly on the outside of the helmet. Insert the long screw with lockwasher into the aligned hole from the backing plate. This screw is tightened until friction against the helmet will hold the latch assembly in place. This step is repeated for the opposite side. Reinstall the earphone assembly.

Don the helmet and insert the bayonets to the third notch. Adjust the straps to provide uniform tension and proper positioning of the oxygen mask to the face.

Adjust the latch assembly by rotating on the screw, either up or down as required, lining up the bayonet centerline with the latch assembly centerline, as shown in figures 13-6 and 13-7.

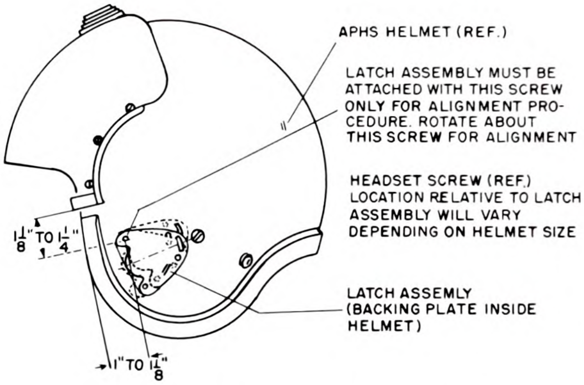

APHS HELMET (REF.)
LATCH ASSEMBLY MUST BE ATTACHED WITH THIS SCREW ONLY FOR ALIGNMENT PROCEDURE. ROTATE ABOUT THIS SCREW FOR ALIGNMENT
HEADSET SCREW (REF.) LOCATION RELATIVE TO LATCH ASSEMBLY WILL VARY DEPENDING ON HELMET SIZE
LATCH ASSEMLY (BACKING PLATE INSIDE HELMET)
1 1/8" TO 1 1/4"
1" TO 1 1/8"

Figure 13-6.—Alignment of the latch assembly.

This provides proper distribution of tension required to support the oxygen mask and facilitates proper release characteristics. If tension is evenly distributed between the two straps on either side, the bayonets should release with no binding tendency.

After proper positioning of the latch assembly, remove the oxygen mask and mark or scrib the location of the three additional mountin screw holes. Remove the earphone assemblie backing plate, and latch assembly, and drill th additional holes 3/16 inch in diameter. Secur the backing plate assembly, and reinstall th earphone assemblies.

Insert the bayonet fittings to the third notc Tighten the four adjustable straps to provide snug fit of the oxygen mask. Maintain equ tension on all straps. When the mask has bee adjusted for normal wearing, two addition steps for increasing tension are actually available since each bayonet can be tightened independently another notch.

APH-6 PILOT'S PROTECTIVE HELMET

The APH-6 serves the same function as th APH-5 with the following improvements:

1. An additional size of sizing pad—ext thin—is provided.
2. The oxygen mask suspension system is a integral part of the helmet (the Hardman fitti is built in).

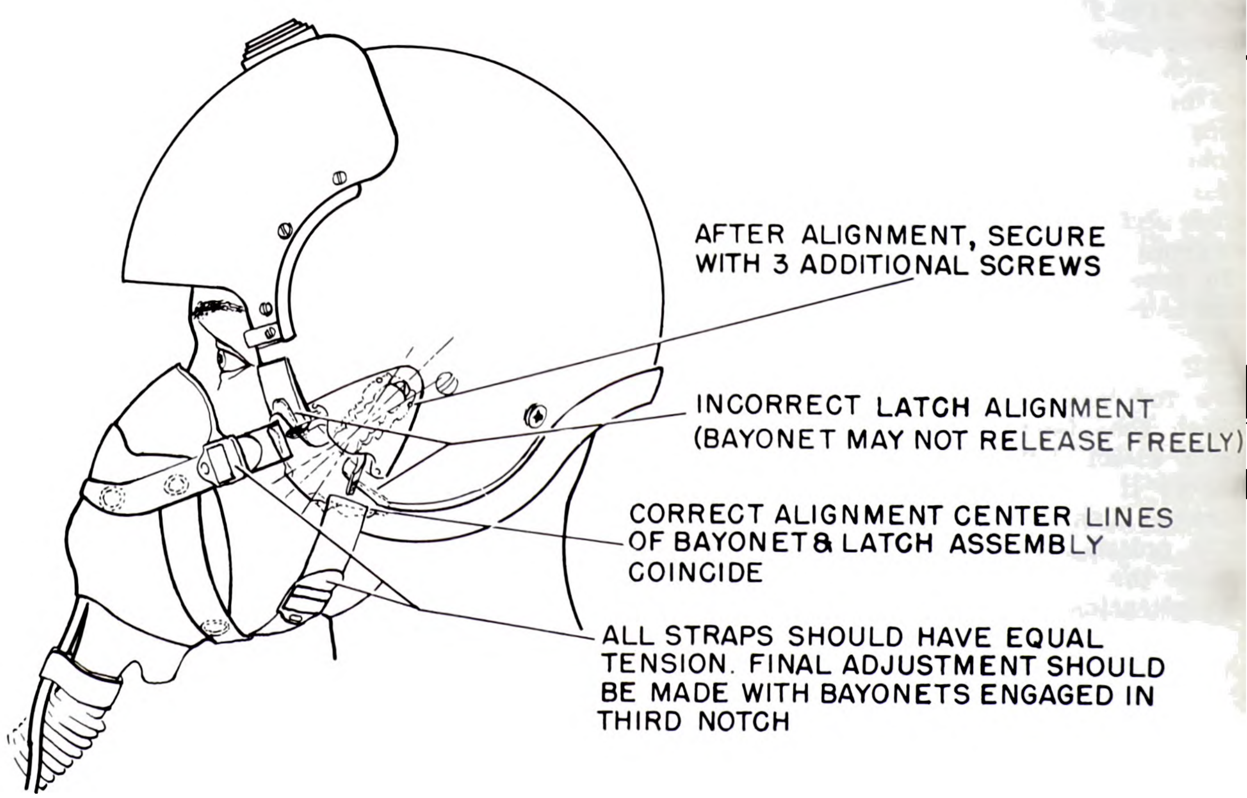

AFTER ALIGNMENT, SECURE WITH 3 ADDITIONAL SCREWS
INCORRECT LATCH ALIGNMENT (BAYONET MAY NOT RELEASE FREELY)
CORRECT ALIGNMENT CENTER LINES OF BAYONET & LATCH ASSEMBLY COINCIDE
ALL STRAPS SHOULD HAVE EQUAL TENSION. FINAL ADJUSTMENT SHOULD BE MADE WITH BAYONETS ENGAGED IN THIRD NOTCH

Figure 13-7.—Alignment of oxygen mask straps and bayonets.

Edgeroll is thinner and made of rubber.
This helmet comes equipped with the new
rd visor lock (screw type lock vice push-
type).
The visor may be removed without remov-
e visor housing.
The chin and nape strap have coverings
rotection of the skin against chafing and for
oved comfort to the wearer.

1 PILOT'S PROTECTIVE HELMET

e BPH-1 pilot's protective helmet (fig.
is designed for use in patrol type aircraft
is adjustable to fit a wide range of head
s. Because of its adjustability, the helmet is
ished in one size only and consists of an
r shell, an energy-absorption liner, an
table webbing suspension, earcup assem-
containing earphones, an adjustable micro-
e, a supplementary visor and visor housing
mbly, an adjustable chinstrap, and the
ssary cords and tabs for mounting oxygen
s and communications equipment.
he outer shell is molded from Fiberglas
ic and epoxy resin. It is designed to provide
e-distribution and penetration-resisting
erties.

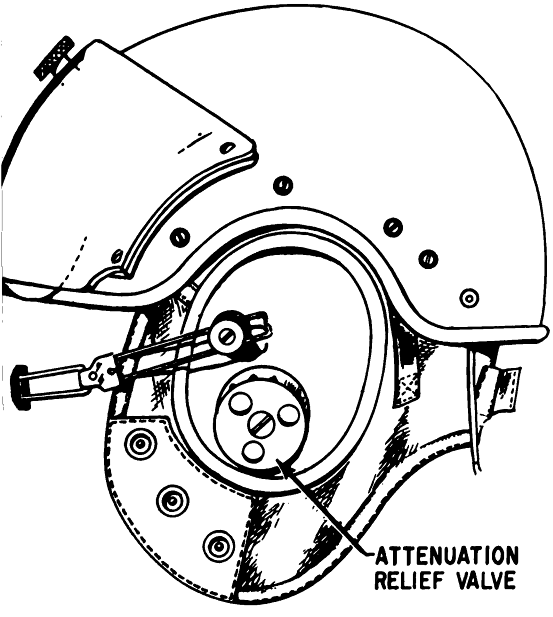


Figure 13-8.—BPH-1 helmet (side view).

The liner is a one-piece, formed unit of polystyrene. It absorbs and dissipates impact energy, thereby preventing skull or brain injury.

The visor and visor housing assembly is stocked as a separate item in the supply system, and is easily attached to the helmet shell.

When attached to the helmet, the visor gives protection against sunglare, windblast, dust, and foreign particles. When not in use the visor should be kept in the UP position in the visor housing. The visor housing is also made of glass fabric and epoxy resin and offers excellent protection for the visor against damage.

The earcup assemblies provide attenuation of outside noise by the use of an inner layer of polyurethane foam material. They are equipped with a special relief valve which, by rotating the valve forward, permits direct conversation to be heard without removal or raising of the helmet.

A boom type microphone is attached to the left earcup of the helmet on a screw type adjustment mount. Forward and rear adjustment can be obtained by loosening the tension on the mount. Inward and outward movement is accomplished by means of a hinge arrangement at the center of the boom. Also installed in the BPH-1 helmet are the type H-87B/U earphones.

Adjustments

To adjust the BPH-1 for individual fit, place the helmet on the head and proceed as follows:

1. Rotate earcup assemblies to the desired direction for snugness and comfort.
2. With the right hand, adjust the nape strap until proper fit is obtained. This adjustment locks automatically. To loosen, lift the buckle and pull.
3. Manipulate the three adjustment straps to shorten or lengthen the suspension system.
4. Adjust the headband by adjusting the strap at the front of the helmet.

OXYGEN MASKS

Oxygen masks are the final link in conveying oxygen from the aircraft system to the user. A satisfactory regulator and oxygen system or a full cylinder of oxygen is of little value to a pilot if his oxygen mask is not operating properly in every respect.

Oxygen masks are pilots' personal equipment; that is, after initial fitting, they are retained by the individual to whom issued. Fitting, adjustments, maintenance, cleaning, and incorporating modifications are the responsibility of the Parachute Rigger.

Two types of oxygen masks are discussed in this section. They are the PRESSURE BREATHING MASK and the DEMAND OXYGEN MASK.

PRESSURE BREATHING MASK

The pressure breathing mask used in the Navy is designated as the A-13A. This oxygen mask is used with composite diluter demand systems, with straight diluter demand systems (with no emergency valve), with automatic positive pressure diluter demand regulators, or with the miniature positive pressure 100 percent demand mask or chest mounted regulator.

The A-13A oxygen masks currently used are satisfactory for flights up to 43,000 feet altitude without regard to service life if properly maintained. The incorporation of the laminate seal (described later) improves fitting and comfort of the mask to the face.

Construction

The A-13A pressure breathing oxygen mask consists of a facepiece, inhalation valves, pressure compensating exhalation valve, microphone cavity, harness assembly, and breathing hose assembly. It has two cheek flaps that protect about half the face.

The A-13A mask is supplied in sizes small, medium, and large. The mask should be selected to fit the facial features of the user.

With the exception of the retention assembly, suspension straps, and laminated face seal, the A-13A mask is molded from Buna-N rubber stock, medium green in color. This stock is compounded to resist mildew and remain flexible at a low temperature.

Operation

When a flow of oxygen under pressure is supplied to the mask, the pilot must exhale at a pressure greater than that of the oxygen intake, in order to open the pressure compensated exhalation valve and complete the breathing cycle. Figure 13-9 illustrates the operation of the A-13A mask with the diluter demand system; figure 13-10 illustrates the operation of the mask with the pressure breathing system.

The inhalation valve assembly is compose a plastic valve seat, silicone flapper, silic valve gasket, and plastic cover. The oxy passes through an inlet hose attached to inlet port of the mask. The oxygen is then through the inlet port to the interior of the ma through two inlet ducts, one on each side the mask. The inhalation check valves prev the exhaled air from passing back through inhalation ducts of the facepiece. A plastic co eliminates the collection of moisture around valve where it may freeze under extremely c conditions and directs the flow of incom oxygen within the mask.

The pressure compensating exhalation va (fig. 13-11) fits into the exhalation valve cav of the mask and the valve stem extends thro an opening in the wall that separates the exha tion port housing and the inlet tube. This arrang ment permits the open end of the valve stem be exposed to the oxygen as it passes from inlet port into the facepiece. The stem of exhalation valve brings oxygen pressure to b against the lower side of the compensat diaphragm (15). This pressure, plus the press of a calibrated spring, causes the diaphragm close the valve. In this position, no oxygen escape from the facepiece.

As the pressure in the facepiece is increas against the main diaphragm (10), because exhalation of the wearer, the combined pressu in the inlet port and the calibrated spring overcome, and the valve opens. Exhaled air escapes from the exhalation port at the bott of the facepiece. The valve is constructed so t a pressure of only 1 millimeter of merc greater than that of which is being supplied the regulator will force it open.

Microphone Installation

The ANB-M-C1 microphone used with oxygen mask is drawn from supply by the pi at the time he draws his oxygen mask and oth personal flight gear. The original installat of the microphone is the responsibility of Parachute Rigger. The repair of any repor malfunctions and modifications is the respon bility of the avionics division and is to performed by electronics technicians.

Before installing the microphone, disasse ble the mask and clean the facepiece a corrugated hose in a solution of mild so Specification MIL-C-18687 (Aer), and wa water.

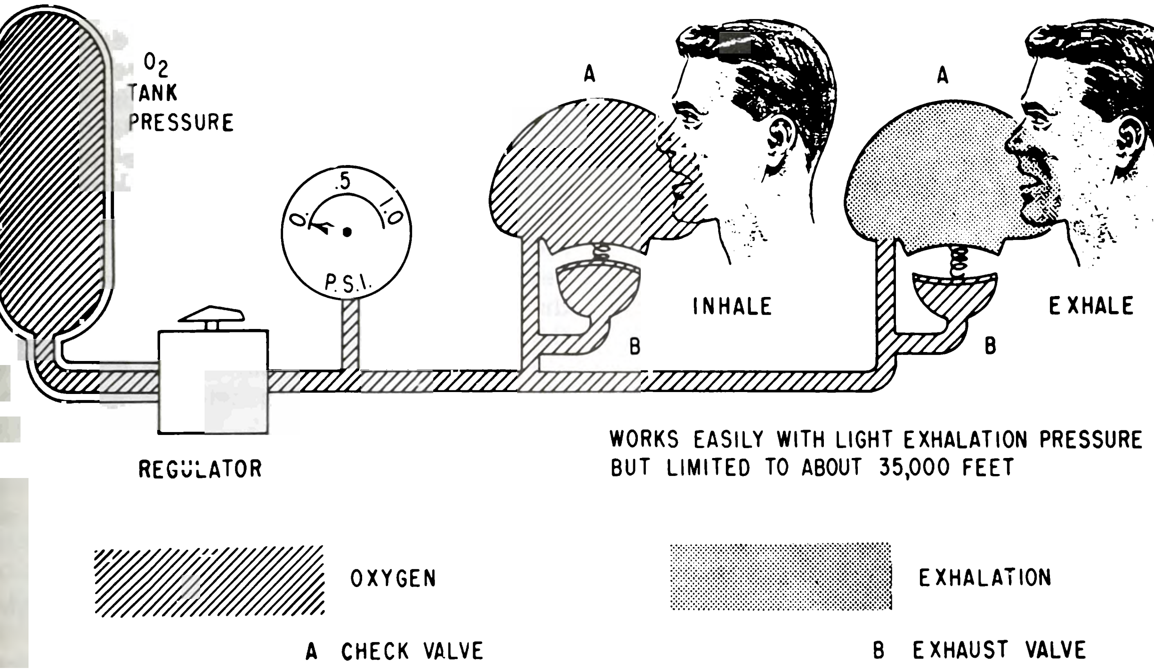


Figure 13-9.—Operation of the A-13A oxygen mask with the diluter demand system.

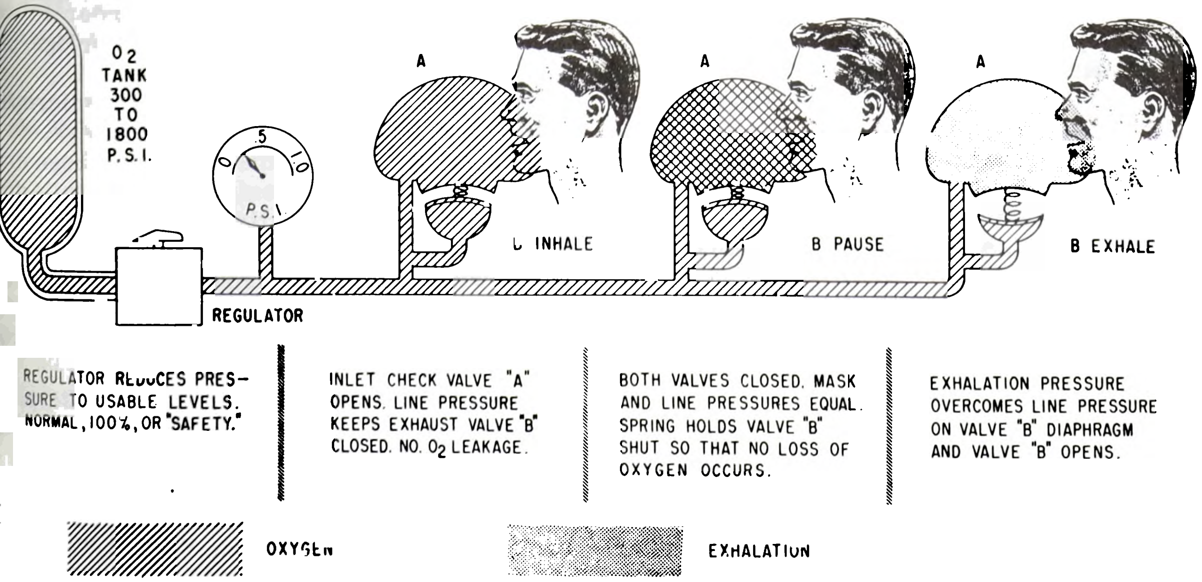
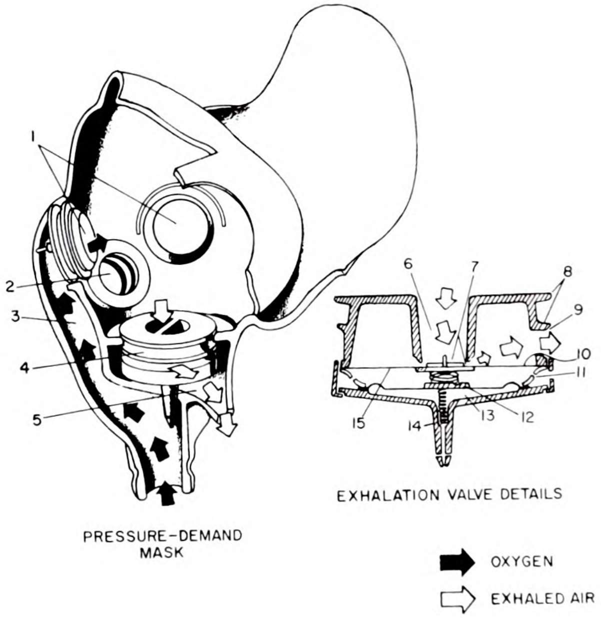

O2
TANK
300
TO
1800
P.S.I.
.5
0
1.0
P.S.I.
REGULATOR
A
B INHALE
A
B PAUSE
A
B EXHALE
REGULATOR REDUCES PRESSURE TO USABLE LEVELS. NORMAL, 100%, OR "SAFETY."
INLET CHECK VALVE "A" OPENS. LINE PRESSURE KEEPS EXHAUST VALVE "B" CLOSED. NO. O2 LEAKAGE.
BOTH VALVES CLOSED. MASK AND LINE PRESSURES EQUAL. SPRING HOLDS VALVE "B" SHUT SO THAT NO LOSS OF OXYGEN OCCURS.
EXHALATION PRESSURE OVERCOMES LINE PRESSURE ON VALVE "B" DIAPHRAGM AND VALVE "B" OPENS.
OXYGEN
EXHALATION

Figure 13-10.—Operation of the A-13A oxygen mask with the pressure breathing system.



1. Inhalation valves.
2. Microphone cavity.
3. Inlet port to mask.
4. Pressure compensated exhalation valve.
5. Outlet for exhaled air.
6. Exhaled air enters exhalation valve here.
7. Plates which stiffen the main diaphragm.
8. Projections on valve housing which seat in mask.
9. Exhaled air leaves the valve here.
10. Main diaphragm.
11. This port permits pressure between the two diaphragms to equalize with the outside atmosphere.
12. Cup which holds hairspring in place between the two diaphragms.
13. Oxygen supply pressure is exerted in this compensating chamber.
14. Exhalation valve stem.
15. Compensating diaphragm.

Figure 13-11.—Cutaway of pressure-demand mask and exhalation valve details.

Remove all traces of any white granular substance which may be present in new masks. If not removed, an excessive amount of these tiny granules can become trapped under the rubber flaps of the inhalation valves there preventing a perfect seat. The inhalation valv and their rubber valve flaps must be perfect seated to prevent an equalizing back pressu into the mask tube. Such a condition w prevent use of the exhalation valve.

Before installing the exhalation valve, cle it in a solution of white merthiolate, removi dirt and dust particles that lie between t diaphragms and their contacting seats. Particl of dirt trapped under the diaphragm can preve the exhalation valve from closing off, there permitting outside air to be drawn in, diluti the oxygen. Dry and reassemble the mask w the exception of the inhalation valves. Leavi the inhalation valves out of the facepiece un after the microphone is installed makes it easi to install.

The steps required for the installation of t ANB-M-C1 microphone are as follows:

1. Remove the microphone cord ''hole plu by pulling it out at the front of the mask. Lubr cate cord with soap solution.

2. Pass the microphone cable through t rubber guide at the front of the mask.

3. Insert tapered long nose pliers throu mike cord hole from the inside of the mas tips of the pliers must show at least 1/8 in beyond the outside edge of the hole.

4. With the pliers opened slightly, ju enough to permit a sure grip on the out diameter of the cord, insert the end of t microphone cable through the elongated ho Handle the pliers carefully in order to avo tearing the hole and the rubber bridge pie joining the inner mask lips.

5. Once the outer diameter of the micropho cable has been grasped by the pliers, do loosen the grip until the cable has been dra through the hole. Loosening the grip while dra ing the cable through the hole usually resu in a second unseen grip on the frail termi wires with subsequent damage to the cables ar or terminal ends. Pull enough cable up into mask to gain an adequate length for connect the terminals to the microphone.

6. Remove the microphone from its plas adapter by unscrewing. This plastic case case cover are of no further use as they are inserted into the microphone cavity of the oxyg mask. Remove the three connections from back side of the microphone.

7. Attach the wire terminals to the mic phone with the lockwashers beneath terminals.

After the terminals have been connected, the mike down to its cavity in the forward on of the oxygen mask. Do not pull the cord tly, and stop the pulling action when the is flush with the rim of the cavity.

Using a blunt instrument (such as a l eraser), work the mike into its cavity and progressively. CAUTION: Do not on plastic portion of mike, press on edge. When a part of the mike has been d into its seat, pull out more of the surplus When doing this, be careful not to break minal connections. Completely seat the n its cavity.

Being exceptionally careful, pull out all emaining surplus cable and remove the between the guide and where it emerges the hole.

Replace the inhalation valves and covers, ng certain that the arrows on the covers are ing downward. If the inside surface of the ic covers have not been scored, preventing rubber valves from sticking to them, comply the latest NavWeps publication referencing modification. All newly manufactured inhala- valve covers will already be modified, ng the field change unnecessary.

2. Place the oxygen mask to your face and k for leakage around the hole where the ophone cable enters the mask. Test the thing action of the mask on a mockup system, safety pressure.

3. Have the installed microphone BENCH KED by the avionics division, making cer- hat it will work properly.

ing and Inspecting A-13A Mask

REFLIGHT TESTS.—Preflight tests should ade to establish the security of all parts, special attention given to the inlet check s and exhalation valve. The plastic shields be scored on the inside and be snap ed over the inlet valves.

he inlet valves and exhalation valve must be from dirt and dust particles. A preflight should be made just prior to each flight taching the mask to the pressure-demand lator installed in the aircraft. The opera- al check should be under both demand and sure-demand conditions. In the event any culty is encountered, the oxygen mask should eplaced or the flight canceled.

Check the mask for fit and minimum mask leakage in the following manner:

1. Adjust the mask securely in place and connect the mask to the regulator breathing tube.
2. With the oxygen system turned on, place the regulator safety pressure selector lever in the ON position. Induce a severe outboard mask leakage by placing two fingers under the mask sealing surface (cheek flaps) and observe the flow indicator. It should remain in the FLOW position.
3. Reposition the mask on the face and after a few respirations, hold the breath and again observe flow indicator. If there is no mask leakage, the flow indicator will remain in the NO FLOW position. If there is any leakage, the flow indicator will assume the FLOW indication position.
4. Adjust the suspension straps until the leakage is stopped.
5. Return the safety pressure selector lever to the OFF position and continue with flight preparations.

MASK HOSE AND FITTING LEAKAGE TESTING.—Affixing the mask assembly to the face with the helmet in place and, using the mask suspension, adjust the strap for a snug comfortable leaktight fit. Attach the MC-3A connector to the oxygen supply and set regulator on 100% oxygen with supply valve off. Inhale sharply and deeply, and hold the inhalation (keep inhaling) as long as possible. If there is no inboard leakage, you will not be able to inhale.

TESTING VALVE ASSEMBLIES.—With both inhalation valves and the compensated exhalation valve installed in the mask assembly, place a clean smooth rubber stopper (size No. 1), in place of the MC-3A connector and perform the following tests:

1. Inhalation Valve: Holding the mask close to the face, but not completely sealed to the face, inhale deeply and then immediately press the mask to the face forming a tight seal and forcibly exhale through the exhalation valve. If the inhalation valves are not closing (sealing) properly, the exhalation valve will not open. If the inhalation valves are seating properly, the exhalation will be smooth and with minimum resistance.
2. Exhalation Valve: Place an obstruction (rubberband or equal) under the rubber flapper of one of the inhalation valves in a manner to prevent it from forming a seal. Repeat the testing procedure as described in test No. 1. If the

exhalation valve is functioning properly, it will not open when the subject exhales, and exhalation throuh the valve will not be possible.

Installation of Laminate Seal

This modification must be accomplished by station or squadron Parachute Riggers or qualified personnel of Overhaul and Repair Departments. Activities not having qualified personnel to perform this required modification should contact the nearest available qualified activity.

This modification on the A-13A oxygen mask is accomplished as follows:

1. Thoroughly roughen the sealing surface of the facepiece with emery paper or any other suitable abrasive.

2. Apply an even, medium coat of cement to the rough side of the laminate and to the surface of the mask previously roughened. NOTE: The container of cement should be tightly sealed when not in actual use.

3. Determine the approximate centerline of facepiece sealing surface and centerline of laminate.

4. When applied cement feels tacky, lightly lay the upper nose of the laminate and the mask sealing surface in such a manner that the points of the respective centerlines coincide. Care should be exercised so that the rest of the tacky surfaces do not contact each other until symmetrical alignment is obtained.

5. After alignment is assured, lay the laminate and press tightly against the facepiece and allow to dry thoroughly (approximate drying time 1 hour).

NOTE: If laminate is not positioned correctly, or if a wrinkle has developed in laminate, strip laminate from facepiece. Clean facepiece with solvent and repeat, using a new laminate.

Installation of Mask-Mounted Regulators

Miniature oxygen breathing regulators are mask or chest mounted and used both in the in-flight and bailout or emergency condition. The various types of miniature regulators are installed on the A-13A mask as follows:

1. Inside the outlet of the Firewel and Robertshaw Fulton miniature regulators there is a small sensing tube on which there is a rubber hose. Connect this rubber hose from the sensing tube of the regulator to the valve stem projecting from the exhalation valve located within the inlet port opening of the A-13A mask. Insert the outlet of the miniature regulator i the opening of the mask in such a manner t the mask touches the body of the regulat

2. The Bendix miniature regulator has small sensing opening which is flush with t end of the outlet tube of the regulator. To co nect the Bendix regulator to the A-13A ma insert the regulator outlet into the inlet p of the A-13A mask so that the mask touch the body of the regulator.

After installing either of the above mentio regulators, install a double band clamp so t one band of the clamp is seated in the depre sion of the mask and the other toward the bo of the regulator. Test the installation by givi the regulator a sudden jerk.

NOTE: Since these instructions are subj to frequent change, the applicable BuWeps Avi tion Clothing and Survival Equipment Bulle should always be consulted before installing a of these regulators.

Cleaning

New masks and masks already in servi have been found to contain a crystalline-li substance which could result in the mask b coming inoperative. The above condition c recur. Therefore a close, continuing survei lance of all masks in service is required.

In cleaning an oxygen mask, remove t breathing tube and clean the interior wi MIL-C-18687, utilizing a suitable test tu brush (approximately 1 1/2 inches in diamete Clean all the mask and particularly the ducti leading to the inlet valve ports in accordan with the instructions in BuWeps Aviation Clot ing and Survival Equipment Bulletin No. 27-5

DEMAND OXYGEN MASKS

The A-14A oxygen mask should be used wi a demand system not having safety pressu features. It is designed to supply adequa oxygen even during bodily exercise in extrer cold in altitudes up to 37,500 feet. With add precautions adequate oxygen is supplied 40,000 feet if the mask is correctly fitte

The A-14A mask assembly consists of mask body which completely covers the no and mouth. It is fitted with a rubber exhalati valve of the flutter type. The adjustable stra of the suspension harness are arranged di ferently in comparison with the pressure ty mask. The corrugated mask tube is equipp e opposite end with a single male connector r. Regular snap fasteners (not the 3-way type) are provided for attachment of the harness of the helmet.

e microphone is installed in a cavity ar to that in the pressure mask. Since it ot designed to hold pressure, there are no tion valves installed in the open ports of -14A mask. The exhalation valve is very le in construction and is designed to pre- ir from entering the mask upon inhalation. means that the rubber flapper is located OUTSIDE of the valve.

rubber cover, or protector, for the inhala- orts is secured to the inside of the face- . It is designed to prevent moisture from ng the ports and/or to prevent the forma- ice in the same vicinity.

ere are no inner lips in the A-14A. The tion valve, seated in the bottom of the mask, permits exhaled air to flow out of the mask through two ports, one on each side of the mask exterior. One of these ports is larger than the other. The larger one allows inspection of the outer portion of the flutter valve and seating of the valve proper.

The exterior microphone cable duct on the A-14A mask is different from the cable duct on the pressure type. In order to insert the cable in the cavity, the tip of the projecting smooth molded cable duct must be cut off. In doing this, care must be taken not to cut off too much of the tip. Removing an excessive amount of duct will result in a hole too large in diameter to adequately seal itself around the cable.

The A-14A mask is available in four sizes—large, medium, small, and extra small. Maintenance of the A-14A is similar to that given for the A-13A in the preceding section. All masks must be kept clean and leakproof at all times.

CHAPTER 14

FLIGHT CLOTHING AND PROTECTIVE EQUIPMENT

In keeping pace with the demands of new developments, articles of clothing worn in flight are becoming more complex. The simple coveralls (light and heavyweight) are used daily in moderate speed and low-altitude flight; however, the conditions experienced during high-speed and high-altitude flight have demanded more than a simple warm covering for the body. Consequently, the nature of flight clothing is progressing into a more overall protective stage which guards against sudden losses of cabin pressure and also maintains an oxygen pressure range necessary to life.

Besides protection from moderate to severe temperatures there are other more complicated elements and conditions to be considered. The attainment of recent higher speeds and higher altitudes has added greater problems to man's efforts to cope with the elements. To combat the danger of a sudden loss of cabin pressure (explosive decompression), and to extend the limit of high-altitude flight, the doctors and engineers of medical research have developed a full pressure suit.

The full pressure suit is designed to enclose the entire body. Its function is to provide 100 percent delivery of oxygen under a slight positive pressure for breathing and air combined with pressure and temperature control to permit flights in the upper regions hitherto unattainable.

Another item is the antiexposure suit which is worn on all overwater flights in cold regions. The outer rubberized form of the suit, gripping snugly around the wrists and neck, prevents water from contacting the body. The head is the only exposed part. An insulated liner worn close to the body provides the necessary warmth. Without a fully equipped antiexposure suit, a man could not survive in water colder than 32°F. The low limit for a 4-hour exposure with full equipment is about 45°F, and generally antiexposure equipment is required in areas where water temperatures are 59°F and lower.

This chapter is not designed to introduce of the available articles of flight clothing a protective equipment, but offers instructions fitting and adjusting those items which ne special attention in their initial servicing. T Mk 4 antiexposure suit, for example, must individually fitted to the rubber boots. Particul attention must be given to the leg measureme in relation to the available material and individual's freedom of movement. The pr tective helmet must be equipped for stabil and be made adaptable to the oxygen mask. T anti-g Z-2 coverall might require zipper inse in the legs to allow for expansion of the inter rubber bladders. To make the suit legs tight for more effective operation, the leg seams c be altered.

In the initial fitting of clothes, the decisio revolve around the correct choice of fit, whi is that of selecting the proper size. Howeve everyone's measurements do not conform w standard size requirements. In naval aviatio it is the Parachute Rigger's job to make fli and protective clothing fit as nearly perfect possible.

Occasionally, pilots and aircrewmen reque that additional pockets or slings be incorporat in their flight clothing. However, the practi of arbitrarily attaching a sheath knife to t trouser leg of a flight suit might later endang a smooth and uninterrupted egression. In additi to the possibility of hampering an individua movements during escape, the suspension lin of the opening parachute might foul in the shea if it has not been attached properly.

Whatever the requests for modifying fli clothing might be, there are four basic facto which must be considered: First, the weath and climatic conditions under which the artic will be used; .second, the fit of the clothin since the comfort element depends not only the type of clothing but also on the prop fitting; third, appropriateness and safety of t fications in relation to the purpose of the ent; and finally, the authority for the change.

FLIGHT CLOTHING

is the responsibility of the Parachute r to keep on hand and issue to pilots and men many varied articles of flight clothing ding flight suits, flight jackets, boots, s, antiexposure suits, full pressure suits, any other items of survival equipment.

HT SUITS

e summer flight suit is a lightweight (5- cotton twill khaki, orange, or olive drab one-piece coverall type suit. It has a on the sleeve for cigarettes and pencils, ockets on the breast, thigh, and shin for of survival. The coveralls can be worn the anti-g suit, but never in lieu of it. The g suit (described later) is designed to pre- blood from leaving the upper parts of the rather than for the purpose of covering the

e summer suit is used more in squadrons ting multiplace and/or multiengine air- . All garments of this kind are treated with e-retardant compound for the protection of lot and crewmen.

or cold weather flights a two-piece winter flight suit has been developed. This winter suit is made with a nylon cloth face, backed dacron pile and lined with a fire-retardant fabric. The suit does not protect an idual who is submerged in cold water; ver, it should be worn under the Mk 4 anti- ure suit.

HT JACKETS

e summer flight jacket is single breasted, length, and has a slide fastener front re. This front closure is protected by a which runs beneath the entire length of the fastener. The jacket is treated with a fire dant, has a patch type pencil pocket without located on the left sleeve, four patch type n closure pockets with flaps (located on the and left breasts and the right and left sides e waist) and a half belt at the waist in the . It is khaki colored and made of cotton The summer flight jacket is available in n sizes—36, 38, 40, 42, 44, 46, and 48.

The intermediate leather flight jacket is chocolate brown in color and has knitted wristlets and waistband with a moth repellent treated mouton collar. It has a slide fastener closure, is nylon lined, and is available in seven sizes—36, 38, 40, 42, 44, 46, and 48.

BOOTS

Proper boots or shoes play a vital part in maintaining safety, efficiency, and comfort in any climate. Boots or high top service shoes are usually preferable for use in a survival situation. They afford greater protection from sand and insects, provide more support for walking, and are less likely to be lost during bailout than low quarter shoes.

It is the responsibility of the Parachute Rigger to acquaint himself with all types of flight clothing and especially shoes and boots. This will enable him to use good judgment when teaching aircrewmen as to the best methods and equipment for any emergency situation.

GLOVES

The indoctrination of flight personnel in the proper use of gloves and mittens is also an important responsibility of the Parachute Rigger in charge of personal equipment. Flight personnel should be made to realize that the fingers and hands are more vulnerable to frostbite than any other part of the body, and that frostbite usually results in amputation of the injured extremity. Frequent reference to NavWeps 00-80T-56, Survival Training Guide, will give a background in survival training which will enable the PR to assist with almost any situation.

REQUISITIONING

Requisitioning of flight clothing and protective equipment is a function of the supply officer. Naval and Marine Corps student pilot personnel, naval aviators, aviation observers (including navigators, controllers, and radar), and flight surgeons in a flight status are eligible to receive any or all allowed items of flight clothing and protective equipment, not to exceed one complete outfit.

One complete outfit consists of the following:

Compass, wrist.
Computer, navigation Mk 8 type.
Glasses, aviators, sun.
Gloves, flying, leather, summer.

Gloves, winter, type A, B, or C.
Goggles, sun.
Headset, assembly, radio.
Helmet, pilot's protective.
Jacket, flight, leather, intermediate.
Jacket, flying, very light, summer.
Knife, survival.
Mask, oxygen.
Microphone, oxygen mask, type ANB-M-C1.
Shoes, type N-1 field; or boots, flying, safety.
Suit, coverall cotton twill.
Suit, anti-g, Z-2 or Z-3.
Suit, summer flight, (two).
Suit, landing signal officer's, afloat and ashore.
(This item will not be replaced when present stocks are exhausted.)

The above articles of equipment are carried by the supply officer or delegated to an officer in charge of a flight clothing pool. Issues are made directly to the individual concerned and the supply officer or his representative makes an entry in the appropriate columns of the "Flight Clothing Record" of the Aviators Flight Log Book, OpNav Form 3760-3.

When the person is relieved of duty involving flying, he must turn in to the supply officer any flight clothing in his possession. If an article of flight clothing becomes unserviceable for any reason such as damage, wear, or other deterioration, it may be turned in to the supply officer or the flight clothing pool and exchanged for a serviceable item.

If an item is lost or missing for any reason the person charged with custody of the item is required to furnish a Survey Request Report and Expenditure (SandA Form 154) for the missing item.

Winter flight clothing and flight clothing for nonpilot crewmen are the responsibility of the parachute loft and must be maintained in accordance with the allowances listed in the Section H Allowance List.

Requisitioning of these items is usually made by the senior Parachute Rigger or by another Parachute Rigger designated to handle stores for the aviation equipment division.

Defense Department Form DD 1348 is used by aviation activities both ashore and afloat to requisition material. It is available in card form for mechanized supply activities and in 2-, 4-, and 6-part, interleaved sets for nonmechanized use. Local requirements determine the number of copies to be prepared at nonmechanized activities. Each item of material must be requisitioned on a separate form. Exchar material is turned in on the FUR, with no ot forms required. Excess material turned in wi out exchange is covered by DD Form 134 (DOD Single Line Item Release Document).

RECORDS AND REPORTS

Records are important for proper accou ability of flight clothing and protective equ ment, as well as other materials which assigned to the parachute loft for reissue o subcustody basis. Other records which must kept are logging of inspections, recording modifications, repairs, and changes to fli clothing, protective equipment, and other su vival equipment. These include Parach Record Cards, Parachute History Cards, li raft inspection data cards, and static load te of safety belts and shoulder harness. Th records are subject to inspection at any ti by higher authority and should be kept accur and up to date at all times.

FLIGHT CLOTHING MAINTENANCE AND REPAIR

Part of the Parachute Rigger's job is ma taining pilot's and aircrewmen's flight cloth in a serviceable condition. This requires a g basic knowledge of the principles involved tailoring. PR's are not expected to construc suit of clothing from a bolt of material, but expected to be able to make repairs and alt ations to most of the available flight clothing

What are the basic principles involved tailoring? The first and major requiremen knowing how to sew by machine as well as hand. Second, a knowledge of the materials u and the construction of the garment in need repairs is necessary in order for the PR properly analyze the scope of damage and steps to be taken in making the repair. Thi he must have the ability to apply this knowled which can be accomplished only by practice experience.

There are many shapes, sizes, and types clothing which may require repairs. It is ther fore impossible to learn everything about tail ing from a textbook. The best procedure is practice at making patches on scrap mater as well as replacing a sleeve or collar on arment. In this way, one may become ient at making neat, durable, and proper s.

ght clothing is rarely damaged to the t that a yoke or piece in the suit has to be ced. The most common damages are ripped s and small tears in the material, both ich are easily repaired. Stitching a seam pplying a small patch is no great task; er, the same principles regarding the rity of materials apply here as well as parachute. Always strive to use identical ials regardless of the type of repair.

RNING: When making an alteration or , do not stitch through electrical wiring, bladders, or other similar appendages porated in certain types of clothing.

SEWING

dstitching is seldom done by a Parachute r, but there will always remain a need for nd-held needle application of stitching. hines are not always readily available and lack the flexibility inherent in handstitch- Many areas still exist in which the hand- h is the best approach to a repair or an mbling step. Realizing these possibilities, rachute Rigger should know how to make where to use a number of the fundamental titches.

ng

all snags and broken threads may some- be successfully darned; however, darning be used on very small damages only. On m of flight clothing, the snag or broken may be repaired by darning across the art with fine running stitches, using a fine . The thread must be the same color and e as the material. If possible, use a thread d from a seam or the top of a hem of the ent. Smooth out the snag or cut away the n threads from the damaged area.

reinforce, begin darning about one-half beyond the end of the damage. A knot is cessary as there is no great strain on the . Continue sewing with tiny stitches back forth across the tear, running the rows at angles to the long dimension of the damage. the rows irregular in length to distribute train more evenly. Do not draw the stitches ly enough to make the darn pucker. (See 14-1.)

Running Stitch

Small, even amounts of material are taken up and passed over by the needle in the construction of the most versatile of the fundamental stitches. The running stitch is not only used as a temporary stitch as in basting, but also as a means of holding tucks and gathers in lightweight flight clothing. For speed in making this stitch, the needle should be worked in and out of the material several times before being removed entirely. (See fig. 14-2.)

Backstitch

The backstitch is a very strong stitching in which there is a space between the stitches on the outside of the material. The inside of the

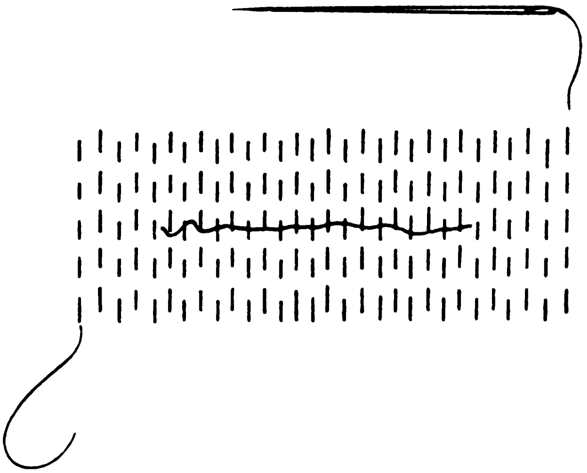


Figure 14-1.—Method of darning a snag or small thread area.

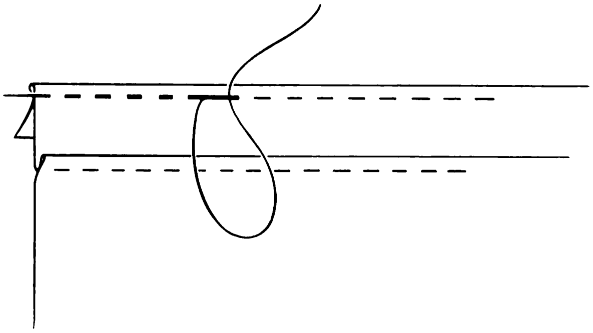


Figure 14-2.—Running stitch.

material will show a continuous run of stitches. There are a few variations of the backstitch, some of which close up the spacing of the stitches on the outside of the material. However, the method usually used by the Parachute Rigger is as follows: Insert the needle into the material one-eighth inch from the right-hand end of the seam. Working from right to left, and from the outside of the material, bring the needle back through, coming out on the outside of the material. The amount or length of cloth taken on the first stitch on the inside should be three times that to be taken by the stitch on the outside. This will govern the size of all subsequent stitches. They should all be evenly made and spaced.

After completing the first long stitch on the inside, move the needle back halfway to the point where the needle had been previously inserted. Bring the needle out on the outside, taking up three times the amount of material necessary for one stitch on the outside.

Continue taking the long stitch on the inside and the half backstitch on the outside, leaving an equal spacing between stitches. (See fig. 14-3.)

Hemming

Hemming is one of the most useful methods of securing the fold or hem turned as the finishing edge of a garment and for securing bindings and facings.

To form a hem, first pin and baste the hem in position on the inside of the material. Insert the needle from left to right along the first turned fold, and bring the needle out from the fold at the right-hand end of the sewing line. This makes an invisible fastening of the thread. With the needle slanting toward the left shoulder, take up a few threads of the single thickness fabric directly under the fold, then bring t needle out through the edge of the fold. Movi to the left a very short distance, take anoth stitch like the one just completed. This mak a slanting stitch on the outside of the mater and as the sewing progresses toward the left slanting stitch is made on the inside of material.

The greater the amount of material taken on the needle and the coarser the needle a thread used, the more conspicuous the stitch w be on the outside of the garment. Fasten off sewing with two or three small stitches on of the last one; then slip the needle from left right in the fold of the material for an inch two before cutting off the thread.

When hemming, hold the garment so that second turning or the edge of the hem is in left hand, over the first finger of that hand, a the bulk of the material is on a table. (See f 14-4.)

Catch Stitching

In catch stitching, the sewing threads cr each other on the inside of the material and row of small stitches shows on the outside. a general rule, the stitch is used on the ins over unfinished edges in heavy fabri especially wool, where a turned-in edge wo be bulky and unsightly on the outside.

The catch stitch is one of the few handm stitches that is worked from left to right. Af a raw edge is held in place with pins or basti insert the needle at the left-hand end of the se or other line of sewing under the edge of material to conceal the knot at the end of sewing thread. Then, with the needle h

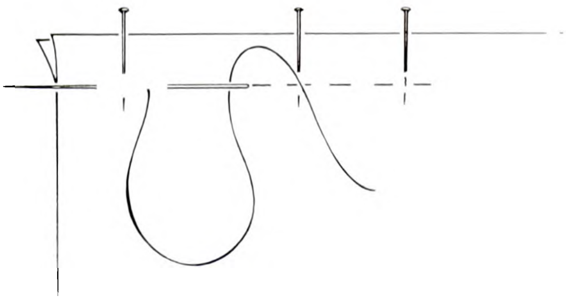


Figure 14-3.—Backstitch.

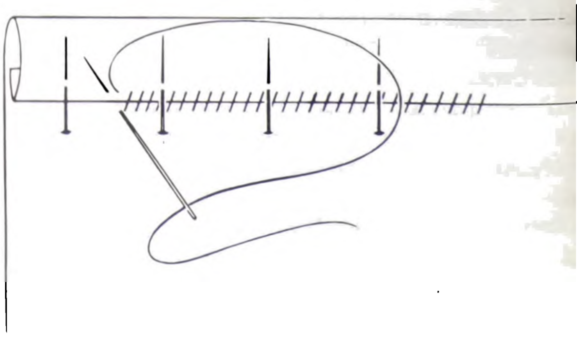


Figure 14-4.—Hemming.

el to the raw edge, take a small stitch h the single thickness of material above edge with the needle in the same position, l to the cut edge about one-eighth or one- inch from and to the right of the first Take the next stitch below the raw edge ntinue alternating the stitches above and the cut edge. The degree of the angle of rossed threads is determined by the space n stitches. (See fig. 14-5.)

Needle Stitch

double needle stitch is comparable to the e stitch, except that the thread used is not in the material as in the 301 machine

reparing to sew a series of double needle es, thread each end of a length of cord e eyes of appropriately sized needles. one of the needles through the material half the length of cord is visible on either An awl can be used to make clean holes oth needles to pass through; however, take not to damage the material with the awl. termine the length of stitch, marking the es on the material if necessary. Pass one needles through the material, drawing the up tight enough to lie flat along the e as in starting to lace a shoe. Be sure w the first stitch evenly. Pass the other e through the same hole in the material the opposite direction of the first. Be l not to catch or cut the thread when g the needles through the material. Con- making stitches by passing each needle h the hole previously made by the other.

OVAL OF STAINS

he removal of spots from flight clothing is o means an easy task nor one to be con- ed lightly. It requires a knowledge of the osition of the material and of the cleaning substance to be used, in order to prevent unnecessary damage to the garment when cleaning. When in doubt on these points, one should take the garment to a good dry-cleaning establishment and if possible tell them what caused the stain.

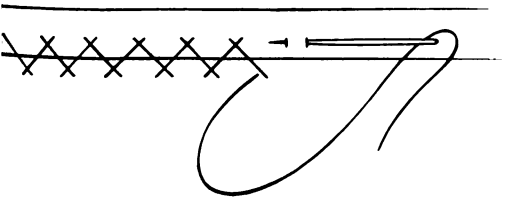


Figure 14-5.—Catch stitch.

Any stain which resists the normal washing process is ordinarily removed by "spotting." This process requires skill in identifying the stain and in using the proper agent to remove the stain without damage to, or otherwise affecting, the material. When testing stains, it is advisable to start with the simplest operations, since some cleaning agents tend to "set" stains, rendering them very difficult to remove.

Contact with organic solvents such as alcohol, acetone, benzol, chloroform, and glacial acetic acid will affect synthetic fiber adversely and should be avoided. Before any chemical cleaning, test the action of the cleaning compound on a seam or hem. This precaution is especially important when using a remover containing acetone, since this chemical will dissolve rayon acetate.

After stretching the stained section of the material over a bowl or a pad of cloth, apply the chemical with a medicine dropper. When the spot has been removed, dampen a wad of cotton with the cleaning solution and rub with very light strokes in the direction of the grain of the material in order to avoid ring stains in the material. Work rapidly and make several brief applications followed by rinsings, and dry as quickly as possible.

When using water for cleaning, work on the inside of the material, placing a white blotting paper or a pad of folded fabric material underneath to absorb the excess liquid. Change this blotter when it becomes soiled or ceases to absorb. Dip a clean, soft cloth in the water and wring it partially dry before brushing it lightly and irregularly over the spot and surrounding material.

Instructions and suggestions for the removal of the more common types of stains are given in table 14-1.

APPLICATION OF FIRE-RETARDANT COMPOUND

Flight clothing requiring re-treatment with fire-retardant compound must be cleaned prior to application of the compound, in accordance with ACSEB 56-61A.

Table 14-1.—Instructions for the removal of stains.

Stain	Cotton or linen (vegetable fiber)	Wool or silk (animal fiber)
Acids	Nitric acid sometimes yellows white textiles. Phosphoric acid (frequen present in sirups) yellows wool. The color of many dyed materials destroyed by acids. Sponge with dilute ammonia or sodium bicarbona Rinse well in water afterwards.	
Alkalies	Alkalies sometimes destroy certain colors. Sponge with dilute acetic ac Rinse free from acid afterwards. Starch is yellowed by alkalies at h temperatures.	
Blood	Removed in standard washing process. Javel water removes hemoglobin, the coloring matter. Stubborn stains may be removed with glacial acetic acid. Be careful of colored materials. Rinse well.	Removed in standard wash process. Sponge with a li hydrogen peroxide to remove l traces.
Chewing gum	Carefully remove mechanically, then spot with safety solvent. Finally wash hand with soap. Rub well.	
Cocoa, coffee, and chocolate.	Remove in the standard washing process.	Residual traces may be removed oxidizing bleaches.
Grass	Removed in the standard washing process. Treat last traces with methano sodium bisulfite. Cotton and linen may also be treated with Javel wa	
Grease	Grease stains are usually removed in the standard washing process. If an exceedingly resistant stain is encountered, it may be softened with a mixture of lard and oleic acid (2 parts oleic acid to 98 parts of lard) and washed. When the oleic acid comes in contact with alkali in the usual bath, soap is formed, and being in such intimate association with the grease, removes it rapidly. Organic solvents may also be used as listed in next column.	Stains surviving the regular laund ing process must be treated an excess of soap by hand or one of the organic solvents s as isopropyl alcohol (Spec. M F-5566) and a safety solvent Stoddard Solvent. CAUTION: Avoid inhaling va and use with adequate ventilat
Gum or resin	Use any of the following solvents: Turpentine, safety solvent, isopr alcohol, or kerosene. The specific solvent must be determined by ac test, since the solubility of different gums varies.	
Iodine	Spot with sodium thiosulfate solution and rinse thoroughly.	
Machine Oil	The stain can be removed only after the manner described under ‘‘Grea If the stain is caused by bearing grease, it may contain some iron other metal.	

Table 14-1.—Instructions for the removal of stains—Continued.

Stain	Cotton or linen (vegetable fiber)	Wool or silk (animal fiber)
ew and mold--	Fresh, light stains are removed by standard washing process. Old stains may be treated with Javel water.	Potassium permanganate followed by hydrogen peroxide. Soap and water are satisfactory in very light cases.
------------	Removed in standard washing process. If an iron residual stain persists, remove as usual with oxalic acid or laundry soap. Rinse well.	
t and Varnish-	These stains are more easily removed if treated before being laundered. Rub oleic acid into the stain. This is very important, especially for heavy stains. Then soak in an oleic acid-benzine mixture overnight (1 part oleic acid to 3 parts benzine). In the morning wash the material well in hot soda ash solution. The soda ash reacts with the oleic acid to form a "red oil" soap.	Use the following solvents: Turpentine, Stoddard Solvent, and safety solvent. CAUTION: Use with adequate ventilation.
piration -----	If not removed in the standard washing process, treat with Javel water or with potassium permanganate solution followed by oxalic acid.	If the stain does not wash out, use potassium permanganate solution followed by oxalic acid.

fter laundering the garment, it should be anically extracted or hand rung to damp then immersed in 6 gallons of water cong 2 pounds of borax, 1 1/2 pounds of boric and 1 1/2 pounds of diammonium phosphate. garment should be agitated in the solution pproximately 10 minutes at a solution temture of 100° F, then damp dried in an actor.

xtreme care must be exercised in extracting nents before and after application of firerdant finish in order to apply and retain cient chemicals to give the required proon. Prolonged exposure to ironing temture will also impair effectiveness of this tment. High temperatures may be employed ressing, provided the water can be removed kly and the clothing does not remain in act with the iron or mangle long enough to h a temperature of 250°F.

PROTECTIVE EQUIPMENT

Included in this category are the full pressure suit, torso harness suit, anti-g suit, antiexposure suit, arm retention sleeves, life preservers, and survival kits and related equipment. Many of these items are used in conjunction with a seat ejection system. Although the PR is not responsible for ejection system maintenance, he should be familiar with the principles of operation and understand how certain items of protective equipment are related to the ejection system. A brief description of a typical system is therefore given in the following paragraphs.

EJECTION SYSTEMS

Seat ejection systems currently used in naval aircraft are designed to provide safe escape from the aircraft at all altitudes and speeds.

The system described here is used in the A-5 (A3J) series aircraft. The Martin-Baker system, used in a number of other aircraft, is described in chapter 8.

The A-5 ejection system consists of the following main components: seat and carriage assembly, seat adjustment system, seat stabilizing chute system, seat-man separation system, integrated harness system, arm retention system, survival kit system, and an NB-7E personnel parachute. The survival kit system includes an emergency oxygen supply, PK-2 pararaft, survival equipment, pressure suit controller, and a composite disconnect. (See fig. 14-6 (A).)

The composite disconnect provides for the connection of pressure suit ventilating air, oxygen, anti-g suit pressurization air, and communications wiring. Manual operation of the emergency oxygen supply is provided by a green ring on the forward edge of the survival kit.

The integrated harness system performs the functions normally accomplished by the parachute harness, lap safety belt, and shoulder harness.

A harness release handle (fig. 14-6) permits manual release of the integrated harness, harness takeup inertia reel strap, survival hold-down fittings, and parachute cable.

A pair of gas actuated ejector pins and a drogue chute static line with an attached cutter provide for drogue chute separation after seat-man separation and parachute deployment. The parachute contains a static line ballistic-delay cutter to sever the lanyard after parachute deployment.

The ejection system is operated by pulling the face curtain handle (fig. 14-6 (A)) or by squeezing the handgrips, located on each knee raising frame. The ejection sequence is as follows: The canopy is jettisoned; the occupant's arms, legs, and shoulders are positioned; the rocket fires, propelling the seat-man combination to a safe recovery. (See fig. 14-6 (B).)

FULL PRESSURE SUIT

The full pressure suit currently in use is designated Mk IV. The suit consists of four main components—the torso, helmet, gloves, and boots. The Mk IV suit is illustrated in figures 14-7 and 14-8 and is described in the following paragraphs.

The full pressure suit is a flexible pressure-tight garment for wear by flight personnel in aircraft with high-altitude capabilities. Its fun tion is to protect personnel from the effects low ambient pressures and of explosive d compression. It is also intended to protect t wearer from wind blast and exposure to extre ambient water temperatures as a result emergency ditching of an aircraft.

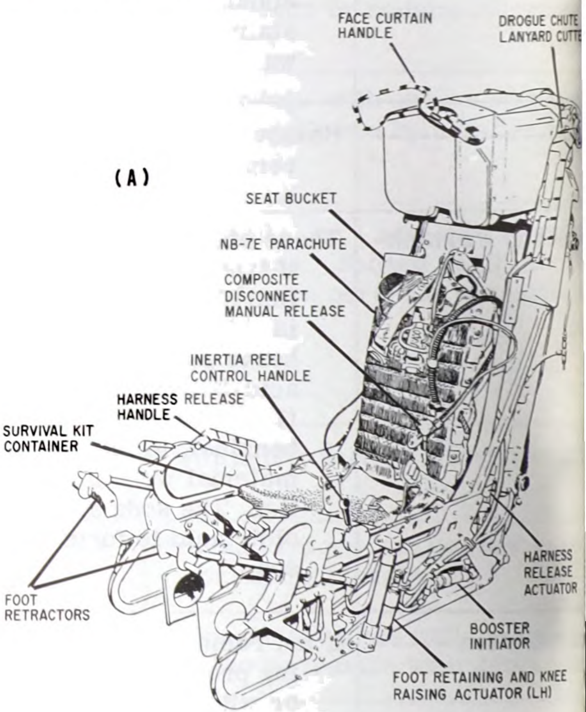


Figure 14-6 (A).—Ejection seat and related equipment.

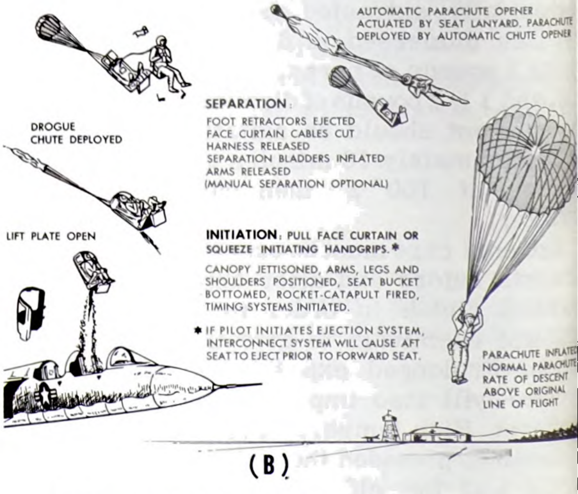

AUTOMATIC PARACHUTE OPENER ACTUATED BY SEAT LANYARD. PARACHUTE DEPLOYED BY AUTOMATIC CHUTE OPENER
SEPARATION:
FOOT RETRACTORS EJECTED
FACE CURTAIN CABLES CUT
HARNESS RELEASED
SEPARATION BLADDERS INFLATED
ARMS RELEASED
(MANUAL SEPARATION OPTIONAL)
DROGUE CHUTE DEPLOYED
LIFT PLATE OPEN
INITIATION: PULL FACE CURTAIN OR SQUEEZE INITIATING HANDGRIPS.*
CANOPY JETTISONED, ARMS, LEGS AND SHOULDERS POSITIONED, SEAT BUCKET BOTTOMED, ROCKET-CATAPULT FIRED, TIMING SYSTEMS INITIATED.
* IF PILOT INITIATES EJECTION SYSTEM, INTERCONNECT SYSTEM WILL CAUSE AFT SEAT TO EJECT PRIOR TO FORWARD SEAT.
PARACHUTE INFLATED NORMAL PARACHUTE RATE OF DESCENT ABOVE ORIGINAL LINE OF FLIGHT
(B)

Figure 14-6 (B).—Low altitude escape sequence.

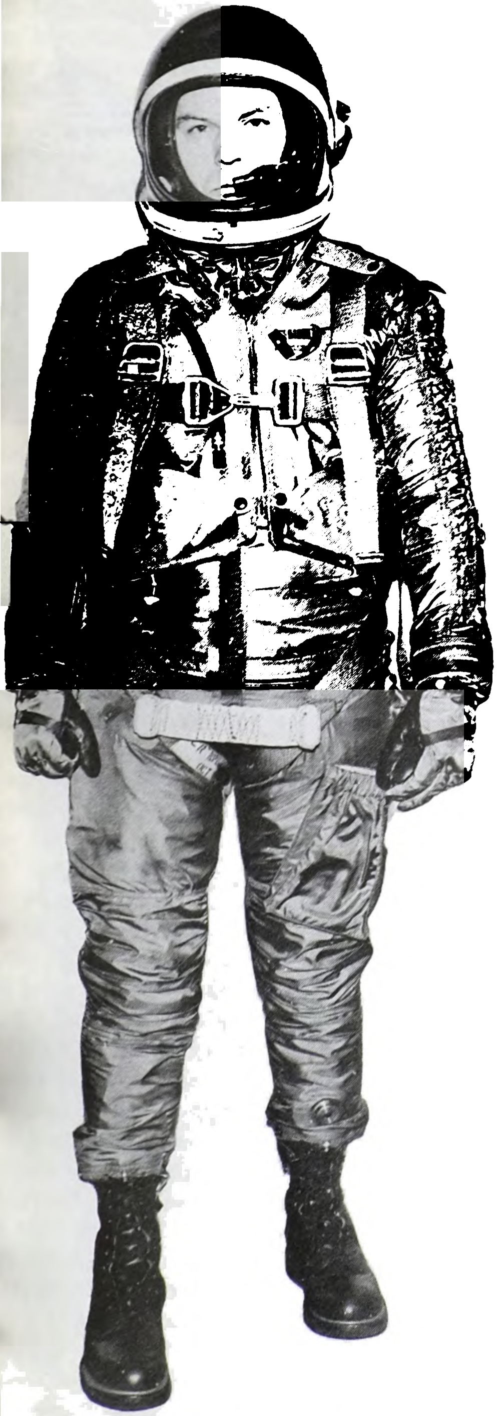


Figure 14-7.—Full pressure suit.

The suit torso is tailored to be a closely fitted coverall type garment encompassing all of the body except the head and hands. A neck ring is the attachment point of the helmet and also acts as a pivot for the head and neck. Incorporated in the helmet are the oxygen breathing regulator and communications system. The gloves extend from the lower one-third of the forearm to the fingertips. The helmet and gloves when attached to the torso, form a complete assembly.

"Iron age" boots are used with the Mk IV full pressure suit. They are made in two configurations. One type is used as a regular flying shoe and is conventional in donning and doffing methods. The other type has a slide fastener in addition to the lacing feature for ease and speed in donning and doffing. Both types are designed to lace above the ankles. This prevents loss during bailout and offers support for the ankles upon landing.

Suit accessory equipment consists of an integrated flotation garment with parachute harness and waffle weave underwear for use in cold climates. (See fig. 14-9.) An anti-g suit is worn when operational requirements warrant.

Under normal conditions, with the cockpit adequately pressurized, the pressure suit remains in an unpressurized state and any slight pressurization that occurs is due to high ventilation flows. The ventilation air is supplied from the aircraft air-conditioning system, monitored through the pilot's manual control valve, and channeled by way of a disconnect in "Trilok ducting" which is an integral part of the torso. This air flows through the ducting and exits at the wrists, ankles, crotch, and neck ring. It then flows into the body of the suit so as to remove excess moisture and cool the body. The air leaves the suit exhaust port and is expelled through the relief port of the suit controller into the cockpit. In addition to ventilation, this air also pressurizes the suit when required.

The full pressure suit system is designed to respond to, and function under, several distinct conditions that might be encountered in flight.

1. In normal flight with adequate cabin pressurization, the suit is provided with a flow of ventilation air to maintain the body at a comfortable temperature level.

2. When cabin absolute pressure falls below 3.5 psi (atmospheric pressure at 35,500 feet), the suit will immediately become pressurized by ventilation air.

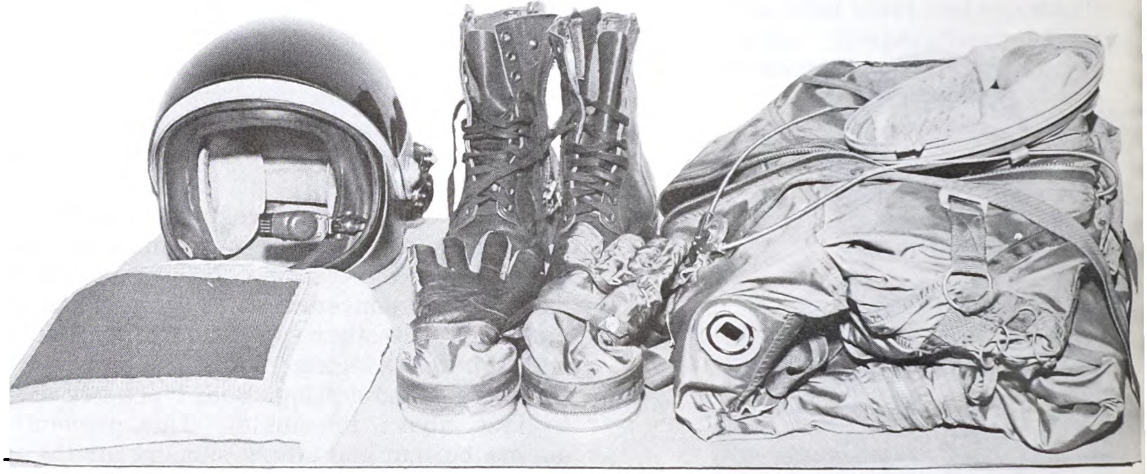


Figure 14-8.—Four basic components of the full pressure suit.

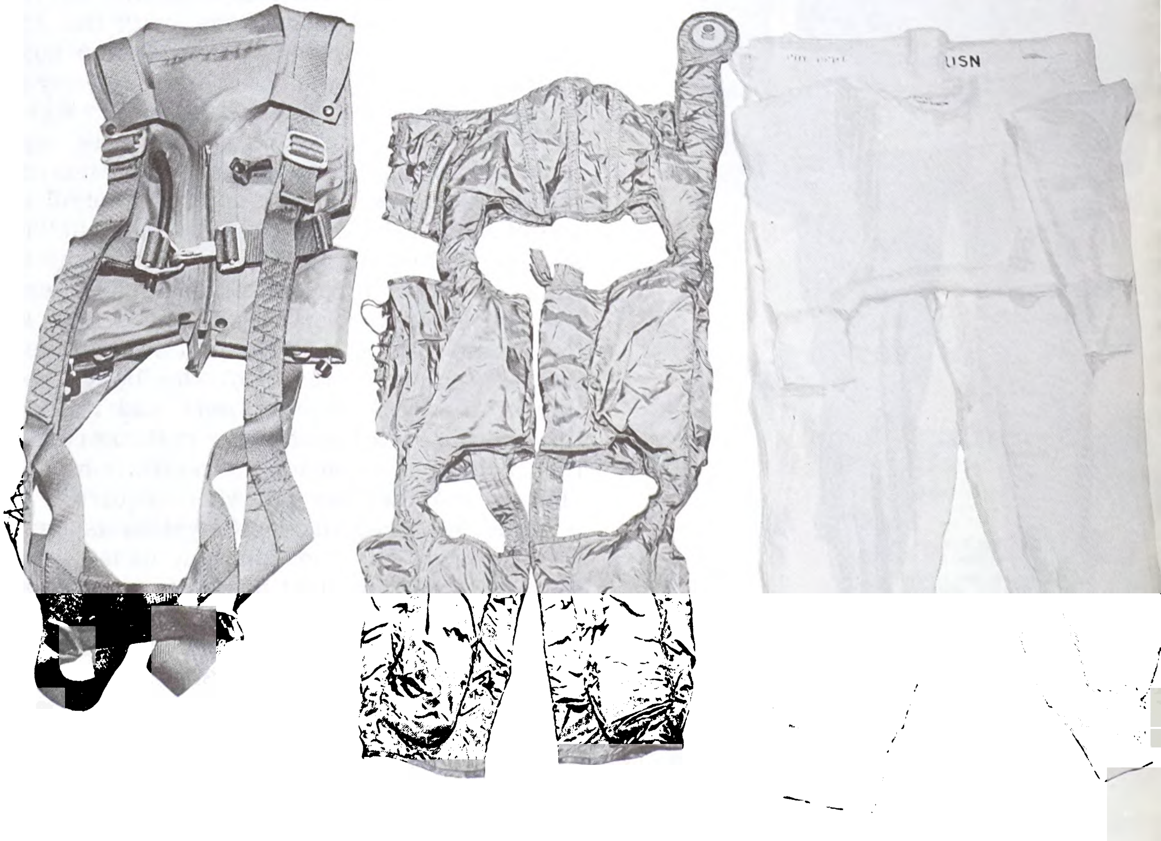


Figure 14-9.—Full pressure suit accessories.

If ventilation air is lost, the aircraft n supply will pressurize the suit as well pply the breathing oxygen.

During bailout the emergency oxygen y will pressurize the suit as well as y breathing oxygen. The design of this n breathing system is unique in that there ver any need for pressure breathing. While ng the full pressure suit, one never has to t to pressure breathing above a slight 1 of water pressure. The freedom afforded is system of not having a mask tightly ed across the face and covering the nose outh is a pleasant advantage. In addition ese advantages, the helmet visor offers a num in windblast protection.

O HARNESS SUIT

ne integrated torso harness suit is de- d for use in Navy aircraft with integrated hute restraint harness systems. (See fig.).)

rior to acceptance of the integrated torso ss suit as a standard item of equipment, xtensive test program was completed to mine its suitability for service usage. As ult of these tests, the integrated parachute ss was adopted for use in ejection sys- . The integrated system reduced overall and weight, improved comfort, mobility, etention, and provided better donning and g features.

he integrated torso harness suit consists of eeveless, legless, fabric garment within n is incorporated the parachute and re- ning harness. The garment is closed by s of a slide fastener running the length of ront panel. The harness is secured for a fit by an adjustable chest strap located on pper front of the suit. This feature consists wo harness straps exposed through rein- ed outlets in the suit. Adjustments in the ess are taken up through these straps. After desired adjustment is accomplished, the ends of the straps are engaged with the rsible friction adapter for security.

he front panel contains an oxygen hose iner channel to eliminate the possibility of oxygen mask being carried away by wind- t during the high-speed bailout. The para- e risers and shoulder harness restraint ps attach to the connector links located on right and left side of the upper chest. The aircraft lap belt attachments engage the two connectors which are located on the lower front panel at the junction of the upper thigh and lower abdomen.

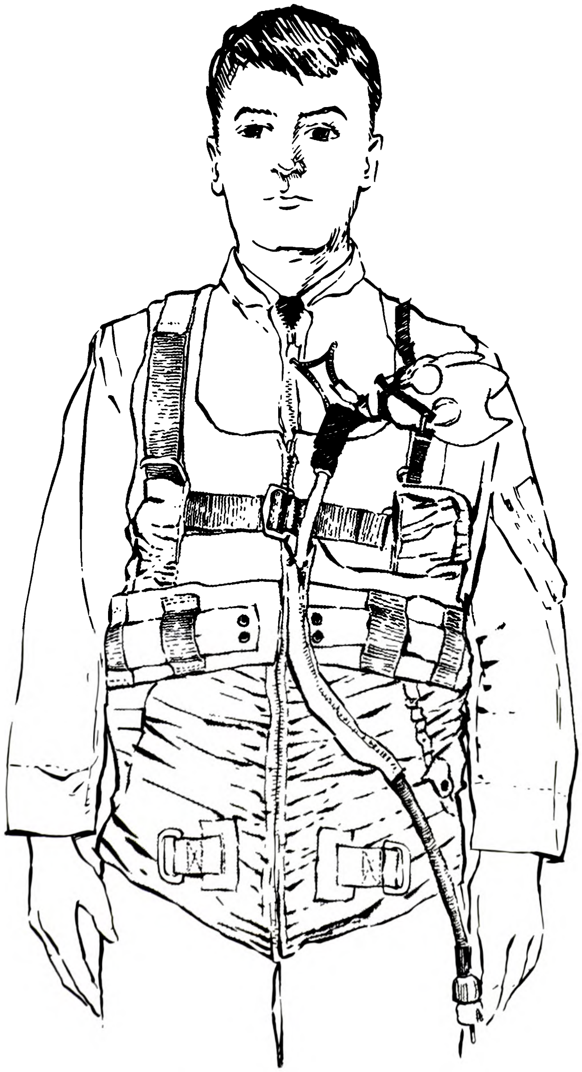


Figure 14-10.—Torso harness suit.

The front panel also contains an attachment snap on the left shoulder strap for the attachment of the oxygen mask when not in use and a protective flap for the oxygen hose coupling at the junction of the hose.

The suit is designed so that by donning one garment and subsequently attaching it at four points the pilot is equipped with a parachute, shoulder harness, lap belt, and pararaft.

Sizing

Although the torso harness suit provides restraint during both normal operation and emergencies, proper sizing to the individual is mandatory to obtain maximum protection assist in sizing, the measurements should taken from the individual, following the listed in table 14-2. Upon determination of prescribed measurements, refer to the for size selection.

Table 14-2.—Sizing chart for integrated torso harness suit.

	Chest circumference		Vertical trunk circum-ference	Waist circumference		Hip circumference		Thigh circumfere	
	Min	Max		Min	Max	Min	Max	Min	M
Small Short	33.0	37.0	61.0	26.0	30.0	34.0	38.0	19.0	
Small Regular	33.0	37.0	64.0	26.0	30.0	34.0	38.0	19.0	
Small Long	33.0	37.0	66.0	26.0	30.0	34.0	38.0	19.0	
Medium Short	35.0	39.0	63.0	28.0	33.0	34.5	39.5	20.0	
Medium Regular	35.0	39.0	65.0	28.0	33.0	34.5	39.5	20.0	
Medium Long	35.0	39.0	67.0	28.0	33.0	34.5	39.5	20.0	
Large Short	37.0	43.0	65.0	32.0	37.0	37.0	42.0	21.0	
Large Regular	37.0	43.0	67.0	32.0	37.0	37.0	42.0	21.0	
Large Long	37.0	43.0	68.0	32.0	37.0	37.0	42.0	21.0	
X Large Short	38.0	45.0	66.0	34.0	40.0	38.5	44.5	22.0	
X Large Regular	38.0	45.0	68.0	34.0	40.0	38.0	44.0	22.0	
X Large Long	38.0	45.0	70.0	34.0	40.0	38.0	44.0	22.0	

NOTES: Chest Circumference.—Nipple level with normal expiration.
Vertical Trunk Circumference.—Over shoulder at base of neck through crotch over buttock.
Waist Circumference.—At navel level.
Thigh Circumference.—At crotch—at right angles to leg axis.

ne individual should then don the suit to
mine that the fittings at the chest and at
nain sling that crosses the buttocks are in
r positions. The chest fittings should ride
e fleshy portion of the chest and not be
ioned too high near the collar bone. The
sling should be positioned well beneath the
cks when the individual is in a seated posi-
rather than behind the individual. Final
mination of proper sizing should be made
e individual entering the aircraft cockpit
nooking-up at the four attachment points.
nookup should be made without excessive
in the restraining harness. It should be
that utilization of the adjustment feature
e harness can be best made by assuming a
ting position and wriggling the body while
ting both sides of the chest straps.

ing

he integrated torso harness suit is worn as
iter garment over standard flight clothing
as the summer flight suit, anti-g suit, and
xposure suit. In view of the increased bulk
e antiexposure suit, when this garment is
, it is necessary that the individual be
l with a torso suit generally one size larger
normally used with other flight clothing.
integrated torso harness suit is furnished
sizes.

RETENTION SYSTEM

o protect the pilot's arms, hands, and
lder joints during ejection, the arms are
drawn from any position and restrained
nst his chest by the arm retention system.
arms will remain in this position until the
-seat separation occurs. The sleeve as-
bly consists of a pair of sleeves, cuffs,
ching straps, gloves, buckles, and snaps.
fig. 14-11.) They are attached to each other
strap over the top of the shoulders, another
p low over the shoulders, and a strap across
chest. Freedom of movement of the arms is
ined through an elastic feature of the straps.
buckles and clasps allow for individual
stment.
E: This item is still in the developmental
e and at this time future use of the arm
ntion system is uncertain.

VIVAL KIT CONTAINER

The survival kit container assembly as
wn in figure 14-12 is a two-piece assembly

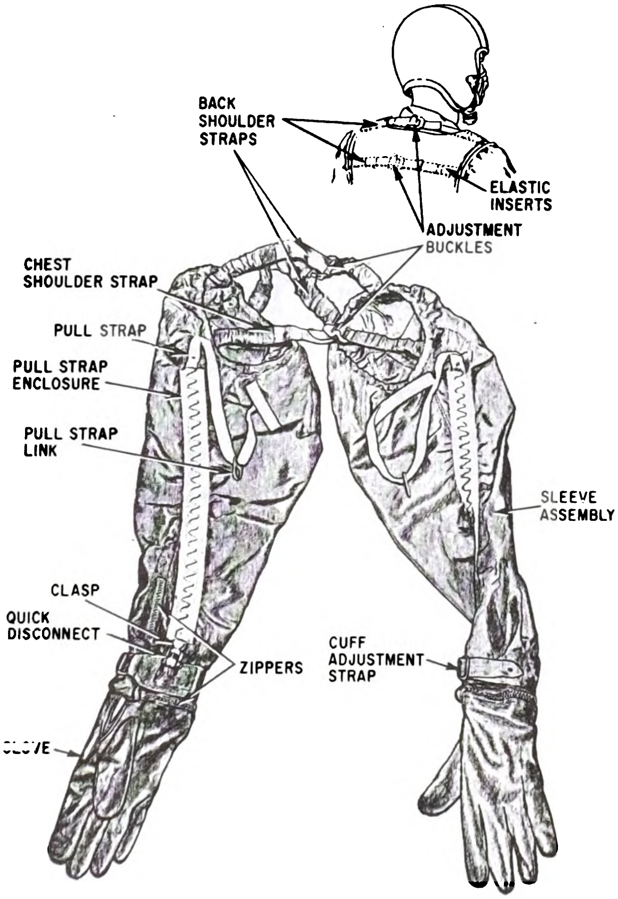


Figure 14-11. Arm retention sleeves.

which acts as a container for the survival kit, liferaft and protective cover, emergency oxygen supply, pressure suit controller, microphone adapter, adapter switch, and related plumbing, clamping, and wiring. The container acts as a cushion in the seat and has a sponge type polyurethane pad bonded to the contoured surface on top of the upper half of the container by a zipper, and the parachute harness is connected to the upper half of the container on both sides.

PK-2 Pararaft Kit and Equipment

The liftraft and items that make up the survival kit are the same as are normally supplied in the PK-2 survival kit. Included are sponge, poncho, distress signals, sea anchor, sunburn ointment, rations, water storage bag, solar still, desalter kit, dye marker, nylon line, signaling mirror, signaling code card, and communications equipment. These items are enclosed in

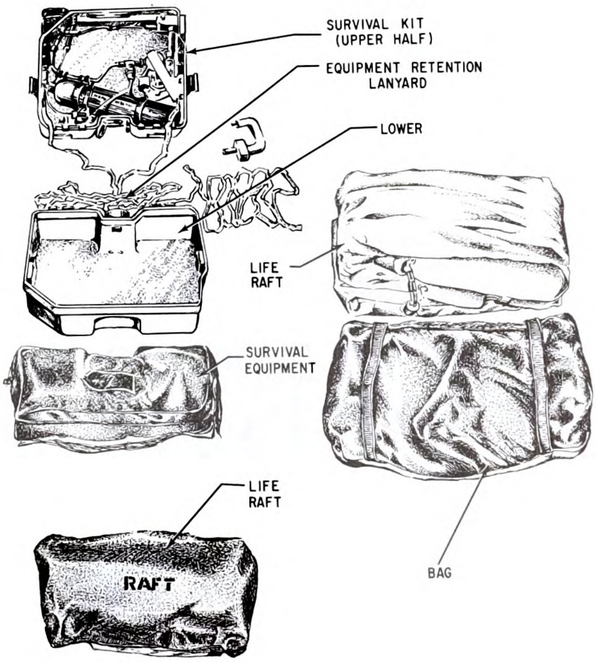


Figure 14-12.—Survival kit and pararaft kit.

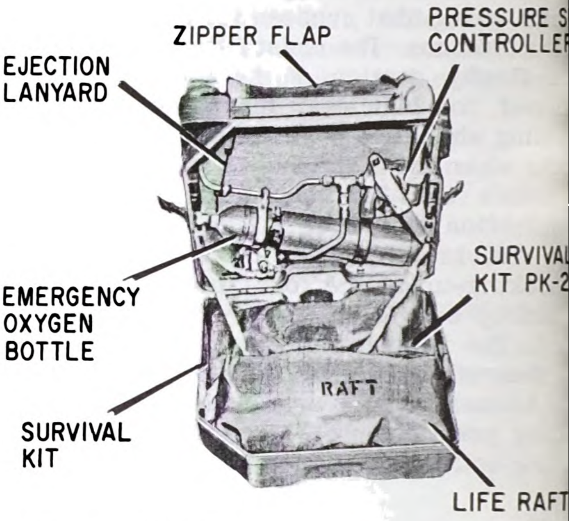


Figure 14-13.—Emergency oxygen suppl (70 cu in.).

the equipment bag and stowed in the lower half of the container along with the liferaft. Both raft and equipment are attached to the upper half by a 25-foot nylon drop lanyard. The upper half of the container is equipped with the emergency oxygen supply and the pressure suit controller.

NOTE: Items included above are considered as typical of a survival kit and deletions or substitutions may be made as directed by area commanders.

Emergency Oxygen Supply

The emergency oxygen supply is contained in the upper half of the survival kit along with the pressure suit controller (fig. 14-13). The capacity of the bottle for some aircraft is 100 cubic inches while other aircraft use bottles with a 70-cubic inch capacity. Figures 14-13 and 14-14 illustrate these two type of oxygen supply cylinders.

The oxygen supply is controlled by the reducer assembly on the oxygen bottle. It is actuated automatically during ejection or may be actuated manually. The reducer assembly (when actuated) delivers a demand flow of oxygen of 0 to 140 liters per minute at an outlet pressure of 55 to 80 psi.

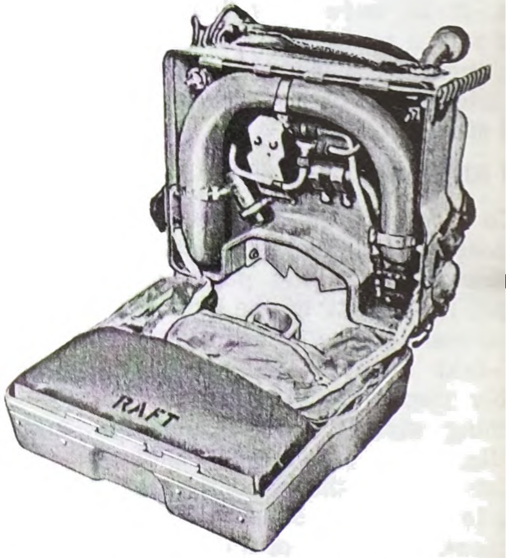


Figure 14-14.—Emergency oxygen suppl (100 cu in.).

The components of the reducer asser are the actuator assembly, relief valve, char valve and cover, pressure gage, control le and outlet port. The actuator assembly cons of a release pin, manual lanyard and ring, automatic lanyard and sleeve disconnect. release pin is attached to both lanyards be actuated by either. The operating forces ired are: manual 15 to 25 pounds, and natic 15 to 35 pounds. The supply of oxygen ained by the emergency bottle is sufficient to ide pressurization and breathing oxygen for occupant from an ejection at the maximum ude capability of the aircraft.

sure Suit Controller

he full pressure suit controller may be lled in any one of several locations, in- ing the seat pan, or for convenience, on the tion seat. The one restriction in mounting a roller is that adequate clearance must be rded around the controller to vent exhaust s to the cabin.

n normal flight with cabin pressure, ventila- air passes through the suit to the controller then escapes into the cabin. If cabin pressure above 35,500 feet and pressure is still available from the aircraft engine, the controller maintains suit pressure at the correct absolute altitude of 35,500 feet. If pressure from the engine is also lost, aircraft oxygen will be automatically supplied by the controller to fill the suit to the correct pressure.

Figure 14-15 shows a cutaway view of a typical pressure suit controller, giving the names of the various chambers and parts which make up a controller. For complete information on the operation and maintenance of pressure suit controllers, refer to ACSEB 3-59 and 3-59A.

An emergency oxygen supply is contained within the survival kit container and is used as an emergency means of pressurization of the suit. If this emergency pressurization is required in a situation other than ejection, it must be initiated by manually pulling the ring to the emergency oxygen bottle control valve. Emergency oxygen is then supplied to the controller to maintain the minimum 3.5 psi pressure within

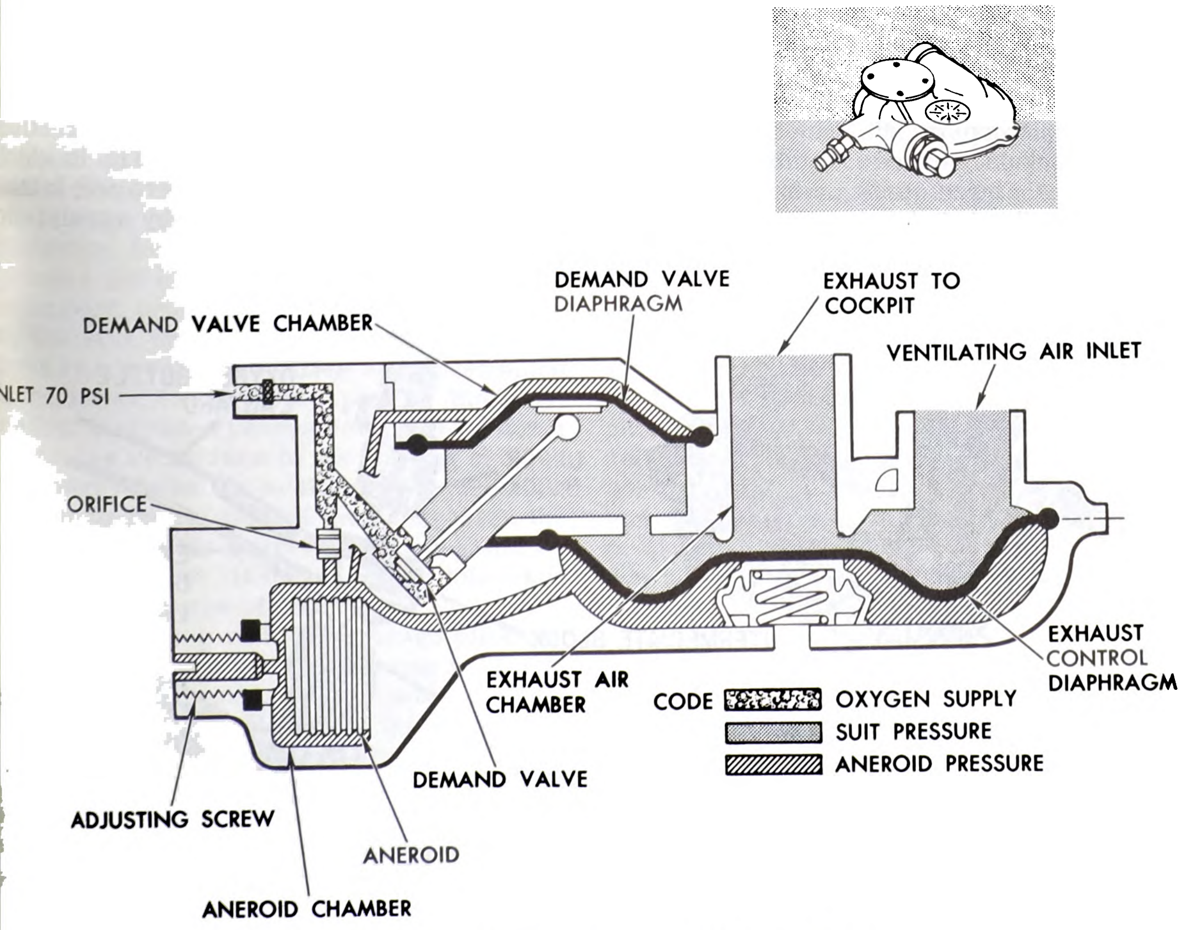


Figure 14-15.—Full pressure suit controller.

the suit. During high-altitude ejection, the emergency oxygen bottle automatically supplies pressure to the pressure suit.

As the seat goes up the rails and the emergency oxygen bottle control valve is actuated, emergency oxygen is supplied to the controller valve. The aneroid in the controller valve actuates automatically to sense the surrounding atmospheric pressure and maintain an absolute minimum pressure within the suit of 3.5 psi above 35,500 feet.

PERSONNEL SERVICES DISCONNECT (COMPOSITE DISCONNECT)

On most aircraft equipped with ejection systems, a composite disconnect is provided. The purpose of the disconnect is to provide a single point connection for quickly connecting and disconnecting the pilot's pressure suit or anti-g suit to the aircraft anti-g system, oxygen system, communications, and pressurization/ventilation air.

Scott Disconnect

The Scott composite disconnect (fig. 14-16) is a small triangular shaped assembly comprised of three blocks. The center or intermediate block is attached to the left-hand rear corner of the survival kit. The lower block is fastened to aircraft and the upper block separates with pilot upon leaving the aircraft. On separa from the seat after ejection, the upper bl remains attached to the intermediate bl providing oxygen flow to the crewman.

The upper block contains the oxygen l pressure suit hose, anti-g suit hose, and el trical leads to the pilot's or crewmemb mike and headset. A manual release ha (yellow pear) is provided for manual rele of the upper block by the pilot or crewmem

ANTI-G EQUIPMENT

Anti-g equipment is currently installe high performance aircraft to counteract effects of prolonged acceleration on the pilot. ill effects of such acceleration range f excessive fatigue and decreased alertnes blackout and unconciousness.

Effects of Acceleration

Although there is no limit to the spee human can endure in straight and level fl in an aircraft, changing speed or direction lead to reactive forces of inertia to which body has a sharply limited tolerance. In the c of extreme stresses exerted by acceleratio

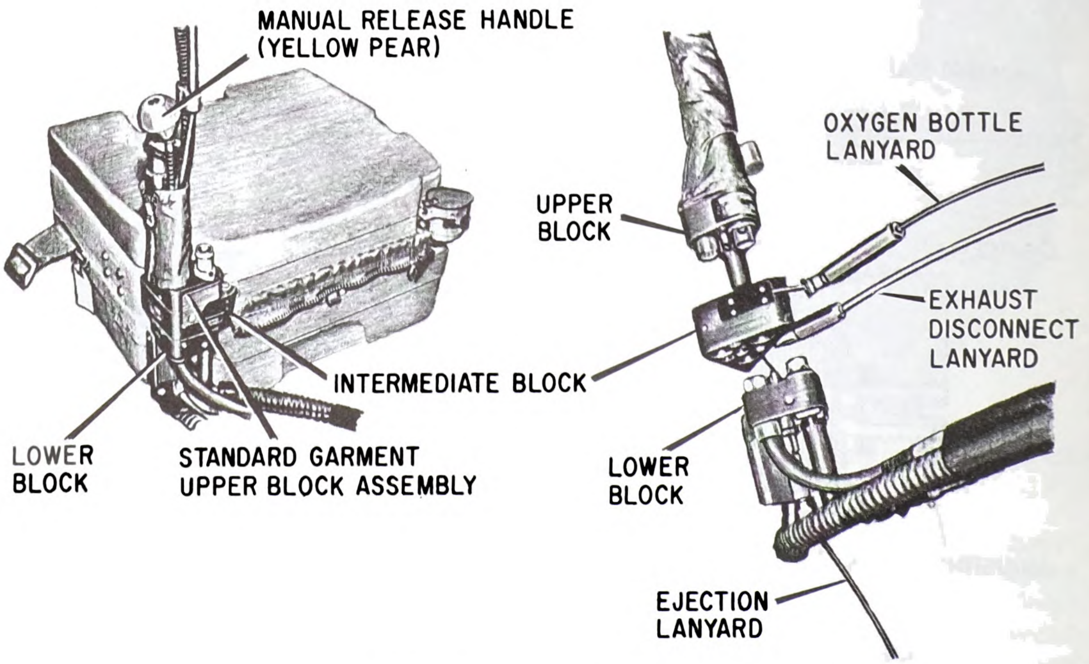

MANUAL RELEASE HANDLE (YELLOW PEAR)
OXYGEN BOTTLE LANYARD
UPPER BLOCK
EXHAUST DISCONNECT LANYARD
INTERMEDIATE BLOCK
LOWER BLOCK
STANDARD GARMENT UPPER BLOCK ASSEMBLY
LOWER BLOCK
EJECTION LANYARD

Figure 14-16.—Scott composite disconnect.

ype met in seat ejection, ditching, or para-
opening shock, the short duration of the
leration restricts its effects. However,
ging the direction of flight often produces
nged radial acceleration (longer than a
nd) which can have dangerous effects.

t 5 g's the pilot's body is exposed to a
of inertia which increases its "weight"
that of its components five times. This
ased "weight" has many effects. The pilot
ushed down into his seat. His arms and
feel like lead and manipulation of the con-
becomes more difficult. In addition, the
weight of the viscera (internal organs)
es abdominal and chest discomfort. Most
rtant, however, is the effect on the cir-
tory system.

t 5 g's the pressure exerted by the column
ood between the head and the heart becomes
about equal to the blood pressure in the
ries. As a result, the pressure supplied
he heart is not great enough to pump an
uate supply of blood to the head.

o counteract these effects, the pressure in
arteries must be increased above the heart
l. At the same time distended vessels and
ue and fluid spaces in the regions below the
t must be restored to normal. This is ac-
plished by the anti-g suit. With the anti-g
em, compressed air is metered to the suit
roportion to the acceleration, and the suit
presses the legs and abdomen of the wearer
an amount proportional to the acceleration.
s, the suit prevents venous pooling in the
omen and lower extremities and forces blood
n the lower to the upper part of the body.
s effect increases venous return to the heart
increases resistance to the shifting of blood
the lower limbs. In addition, it causes the
phragm to be raised and thus decreases the
ance between the heart and the eyes and/or
brain. Altogether, it increases the tolerance
he pilot an average of about 2 g's.

Without an anti-g suit, the average pilot can
hstand 4.5 to 5.5 g's without losing vision or
cking out. With a suit, he is capable of with-
nding 6.0 to 7.0 g's. However, this protection
available only for sustained accelerations of
o 5 seconds or longer in maneuvers other
n snap maneuvers. Anti-g equipment does not
er protection in snap maneuvers where 10 to
g's can be applied in approximately 1 second.
h brief forces are not as harmful to the body
lesser forces which are sustained for a num-
r of seconds.

Anti-g Suits

Anti-g suits are furnished in the Z-2 (full coverall) type and the Z-3, and Mk II (cutaway) types. The full garment (Z-2) resembles the summer flight suit and is issued in 11 sizes. The cutaways are of the skeleton type and are available in only four sizes, since they have more adjustability. All types have five interconnected bladders. A single air pressure hose with a quick disconnect fitting joins the suits with the air pressure source.

Figure 14-17 shows the Z-2 and Z-3 anti-g suits along with the internal bladder arrangement.

Anti-g suits are made of nylon. This material offers flash burn protection equal to treated cotton and in addition affords the strength characteristics necessary in this garment and not found in the cotton fibers available to date. However, since nylon does melt and forms droplets which retain heat and can cause burns, additional clothing should be worn to protect against possible burns from this droplet formation.

Anti-g suits are fitted by the flight surgeon, often aided by a Parachute Rigger. The suit should fit snugly, especially at the waist. A snug fit means better protection and more comfort under g forces.

Experience and accident investigation have proven that burns resulting from the ignition of tight fitting material are far less severe than those resulting from loose fitting material. This is another reason why a correct fit is important.

If there is any doubt about the fit, the wearer should sit in the same position as in the aircraft and inflate the suit orally. The bladders should compress at the waist, calves, and thighs firmly and evenly. Should difficulty be encountered in properly fitting the legs, zipper inserts are available in 3/4-inch and 1 1/2-inch widths to increase leg sizes.

ANTIEXPOSURE SUITS

Antiexposure suits are designed to be worn on cold weather flights by all personnel. They provide warmth and buoyancy in case of emergency bailout or crash landing at sea. They are effective on land and in the water, and without their protection from cold temperatures and near freezing water the individual would freeze to death quickly. A suit and liner have given protection from exposure for 2 hours in water

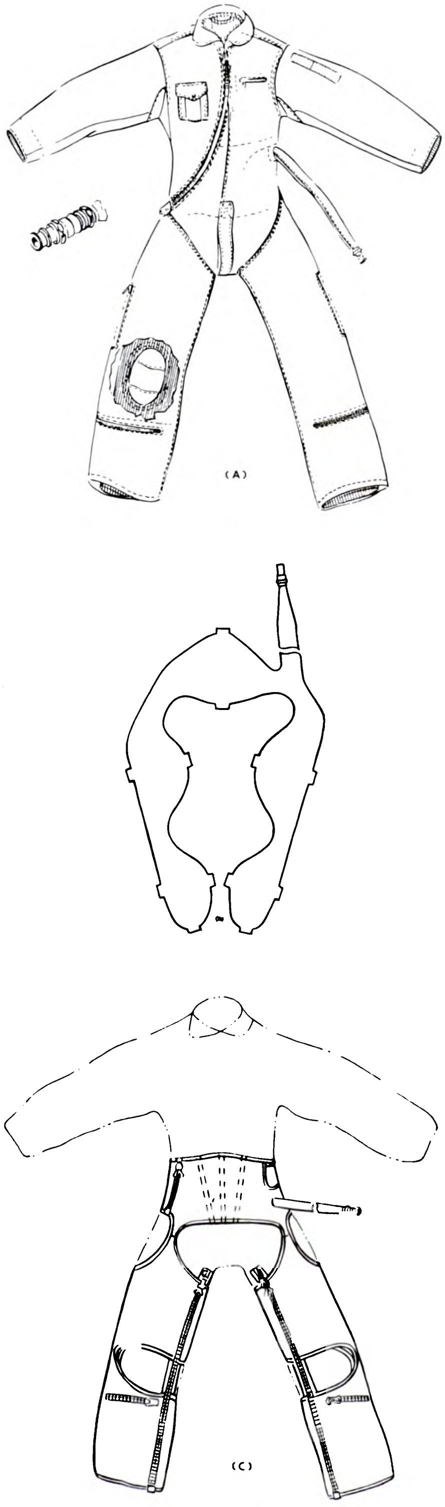


Figure 14-17.—Anti-g suits. (A) Coverall type; (B) internal bladder arrangement; (C) cutaway type.

at 28° F. In subzero weather on land, a suit wi give protection for extended periods of time.

These suits offer a positive means of buo ancy because they are waterproof and retaina Only when full of water will the suit reach ze buoyancy. For greater ease in swimming, o should get into an upright position and relea the entrapped air by pulling the neck seal aw from its seat.

Mk 5 Constant Wear

The Mk 5 coverall assembly consists of t garments—the outer shell and the insulatio ventilation liner. It offers protection from t elements and provides a means of admitti and distributing ventilating air during prefli and flight operations.

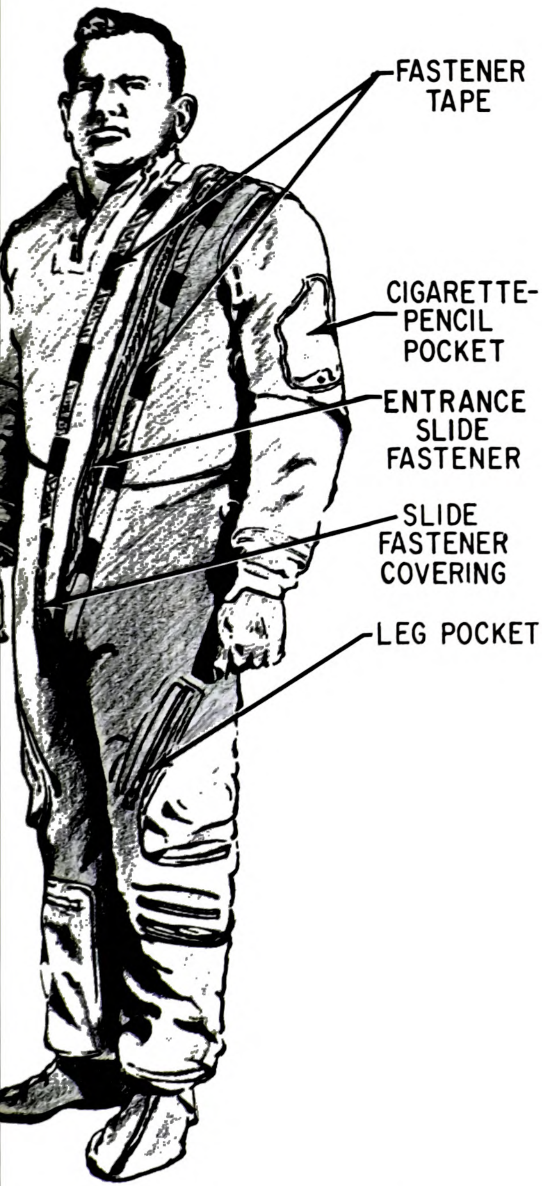
OUTER SHELL.—The outer shell is made a nylon knit material having "stretch" qualiti similar to that found in mens socks, T-shir etc. One side has been coated with a neopre rubber compound for waterproofing. The s is equipped with a long diagonal opening extendi from the crotch upward over the front and sligh over the left shoulder. This opening is seal with a waterproof slide fastener. This fasten is similar to a conventional fastener exce that when closed, it forces together two ove lapping rubber lips. To insure a NORMAL l and for ease in opening and closing the sli fastener, it should be kept lubricated with t appropriate silicone type compound.

A protective flap has been placed along t entire length of the slide fastener for protecti against the parachute hardware, webbing stra and other objects which might cause unnecessa damage to the slide fastener.

This flap is secured with short lengths fastener tape. To close the flap, simply pre the matching sections of tape together; separate, peel the tape halves apart. This t of tape is illustrated in figure 14-18.

Medium sized stretch socks are cemen to the legs of all suit sizes 36S through 40L large size socks are attached to sizes 4 through 46L. Socks of both sizes are furnis in each repair kit for use when an individ requires a size other than the one attached.

The wrist seals are conically shaped attached to the sleeve. This facilitates pass the hands through the constricted opening the wrist seals.



ure 14-18.—Mk 5 outer shell (front view).

ocated at the lower back portion of the legs
14-19) is a pair of ventilation air exhaust
es which serve as the outlet for the venti-
n air after it has circulated over the body.
se valves were designed to exhaust air and
function as watertight seals in the event that
hing in the water becomes necessary. These
es must be kept free of all cements.

Two pockets are provided on each leg and a
rette-pencil pocket is on the left sleeve of
h garment.

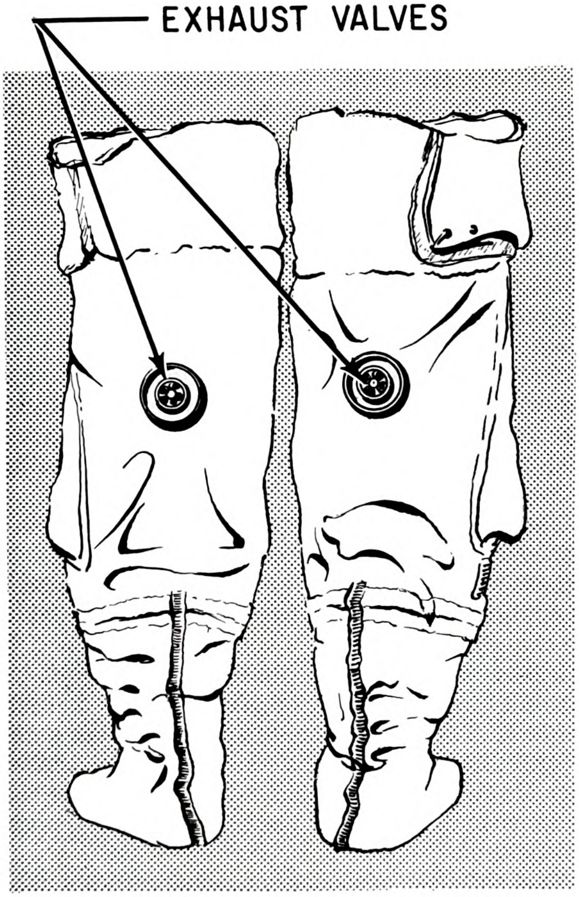


Figure 14-19.—Mk 5 outer sheel (lower rear view).

INSULATION-VENTILATION LINER.—The insulation-ventilation liner (as the name implies) offers excellent insulation as well as ventilating properties. It is made with a lightweight, closely woven nylon outer covering and an inner layer of fire-retardant cotton fabric. Sandwiched between these two layers is a dacron fiberfill batting material. When kept dry these features offer the necessary insulation for the suit.

The ventilation distribution system is integrated within the liner between the outerface material and the dacron batting. It consists of a bladder or reservoir positioned across the full width of the back and a pair of arm and leg ducts. These ducts emanate from the bladder at each of its corners, then distribute the air to points near the sleeve and leg endings of the liner. The air then passes over the body for cooling and finally exits through the open neck seal and/or the exhaust valves of the Mk 5 outer shell.

EXTRA EQUIPMENT.—Also available for use with each Mk 5 antiexposure suit are: a ventilation air hose, and anti-g hose, gloves, footwear, inflatable hood, and a spare parts and repair kit.

The ventilation hose measures 12 inches in length and has a spring-loaded capped disconnect at one end and an elbow fitting at the other. The elbow engages with the air inlet port under the left sleeve, while the spring-loaded disconnect engages with a fitting leading from the air-blower source.

The anti-g hose is approximately 18 inches long, and it terminates with a conventional anti-g male disconnect at one end and an elbow fitting which screws onto the fitting cemented to the Mk 5 outer shell.

The leather gloves are fully insulated and treated to resist water penetration through the leather surface. A rubber wristlet is bonded to the opening of the glove to prevent entry of water into the glove.

Insulated rubber or leather type boots are available in the supply department for use with the Mk 5. The rubber boot is more cumbersome, but offers greater protection than the leather boot. However, additional warmth may be obtained with the leather boot by wearing heavier wool socks.

The inflatable hood is normally folded compactly and stowed in a coverall pocket for easy accessibility. After emersion in the water the crash (protective) helmet should be removed and the hood donned, the snap fasteners engaged, and the hood orally inflated through the oral inflator valve on the left side of the hood.

The repair kit provided is issued on a basis of 1 kit per 10 suits and consists of the following:

One linear yard of Mk 5 outer shell fabric.

Five linear yards of rubber tape.

Two neck slide fasteners for the outer shell.

Two caps and two O-ring seals for the anti-g fitting.

One pair each of gloves sizes 8, 9, and 10.

Two pairs of stretch socks, sizes medium and large.

INSPECTION AND TESTING.—When not being worn, the Mk 5 should be hung inside out on a wide, wooden hanger in a cool, ventilated space.

Whenever the Mk 5 leaks or is suspected of having a leak, and also at the end of each season of wear, the following procedure is used to locate defective areas.

Close entrance and neck slide fastener

Cap the ventilation air and anti-g valve

Turn the suit inside out.

Seal off the neck and sleeve openings (u special jigs described in ACSEB 60-61).

Inflate suit with air to 5 inches of wate (Modify one of the caps covering the ventilatio air ports to permit proper inflation.)

Maintain pressure in suit and apply so solution in accordance with ACSEB 60-61 to cate leaks.

Mark all leaks.

Release pressure and rinse with clean wa to remove all soap solution.

Allow 24 hours drying time before mak any repairs.

Repairs to the Mk 5 are generally made the same manner as those described later the Mk 4 and in accordance with the lat BuWeps Aviation Clothing and Survival Equ ment Bulletins.

CLEANING.—The liners for the Mk 5 ordinarily dry cleaned. However, when cleaning is not feasible, the following launder process may be given.

To a container of clean water having a te perature of 90° F, add any neutral synthe detergent in the proportion of 1 teaspoon gallon. Gently dip the garment into this solut several times to loosen any foreign matt Squeeze (do not wring) out excess cleaning so tion. Place the garment on a flat surface and gently with a cellulose sponge or soft bris brush until clean.

Rinse in clean cold water.

Remove excess water (squeeze).

Suspend the liner on a hanger by the should and allow to dry thoroughly in the air (do spin or use heat in drying).

CAUTION: Do not iron or press t garment.

Mk 5A Constant Wear Antiexposure Suit

The Mk 5A is an improved version of Mk 5. Some of these improvements are lis as follows:

1. The wrist and neck seals are made new two-ply nylon stretch fabric. This fab consists of a layer of neoprene compo sandwiched between two plies of nylon fabr

NOTE: Replacement wrist and neck se for Mk 5 as well as the Mk 5A are made this material.

There are fewer seams in the Mk 5A.

The flexible hose for ventilation and anti-g se is more flexible and can be cut to the ed length.

The hardware for these hoses has been ied to standardize with that of the pressure

Constant Wear

e Mk 4 antiexposure suit consists of three components—an outer garment, an insula- liner, and insulated mittens. The cloth of ter garment is made from a high strength twill which is treated with a water repel- and a fire retardant prior to being coated e side with a neoprene base compound. the suit is assembled, the coated side is on nside of the suit. The suit's wrist and neck are fabricated with an elastomer (an elastic rlike substance, of natural or synthetic r) supported by a network of 100 denier ylon yarn.

quilted material consisting of a layer of acetate batting, sandwiched between two s of preshrunk rayon cloth, is used in the iece liner; a knitted fabric is used in such s as the armpits, wrists, ankles, collar, g-suit aperture. The two-piece winter suit is currently being used in lieu of the ed liner. The outer shell material of the s is coated; the fabric side is left exposed. termediate layer, designed to give warmth, onstructed from a knitted nylon fleece. he outer suit fabric is vapor permeable, ill not admit water. Pockets for gloves and pment are attached, and the entry and relief ings are equipped with a rolled type seal slide fasteners. The boots, attached to the suit, are designed with sealed air chambers cold protection, and are worn with light or um weight socks.

hen the trapped air in the chambers of the s expands at a high altitude and causes sure, the air can be vented by actuating a e on each boot to relieve the pressure. The s are attached by Parachute Riggers and furnished in whole sizes from 6 through 13, hs D through EE.

parka hood, mittens, and a watertight -g suit adapter, which is inserted in the end e hose, comprise the additional items avail- for use with the suit. (See fig. 14-20.)

DONNING.—For full protection and benefit the suit, the following items of clothing should be worn in addition to the liner and outer garment: Heavy woolen underwear, anti-g suit (if needed), and a pair of socks. When the g-suit is worn, the hose must be passed through the openings provided in the liner and outer section. A rubber covering is then passed over the hose, one end extended to the g-suit aperture, while the other end (elastic-like) grips around the outer extremity of the hose near the adapter.

Before putting the suit on, powder the hands and wrists with talc. This prevents binding and possibly tearing the wristlets.

Entrance is made by spreading the suit front and passing the legs through the entry opening. The g-suit hose is passed through the left side of the suit. Insert arms in sleeves by putting on the left side of the suit first and then the right side. Grasp the neck seal in both hands, spread it apart, and pull the seal over the head. Do not permit the seal to bunch up. It must grip snugly without wrinkles. The same holds true for the wrist seals.

CAUTION: When inserting the feet into the boots, pull on the boots—not on the leg fabric. The entry canopy, by comparison, is more fragile than the material of the outer suit; therefore, upon entry, do not pull on the canopy.

FITTING NECK AND WRIST SEALS.—Each man who is issued the constant wear anti-exposure suit must have the wrist and neck seals fitted by a Parachute Rigger. The procedure is as follows:

1. Measure in inches the circumference of the NECK and WRISTS of the man who is to wear the suit. (See fig. 14-21.)
2. Subtract 2 1/2 inches from each measurement and divide the result by 2. For example, a 15 1/2 inch neck minus 2 1/2 inches equal 13 inches. Dividing 13 inches by 2 results in a value of 6 1/2 inches. Now lay the suit out flat so that the top edges of the neck seal meet. Keeping the 6 1/2 inches in mind and measuring along a line at the top of the seal, which is at a right angle to the centerline of the suit, mark off the measurement. (See fig. 14-21.) In applying this measurement, take care to center it, having 3 1/4 inches on either side of the centerline.
3. Keeping the neck seal flat with its edges matched, prepare to make the cut. Starting from left to right or from right to left, whichever side is most convenient, cut along a curved line (dipping below the straight line just marked) and follow the curve of the original edge of the

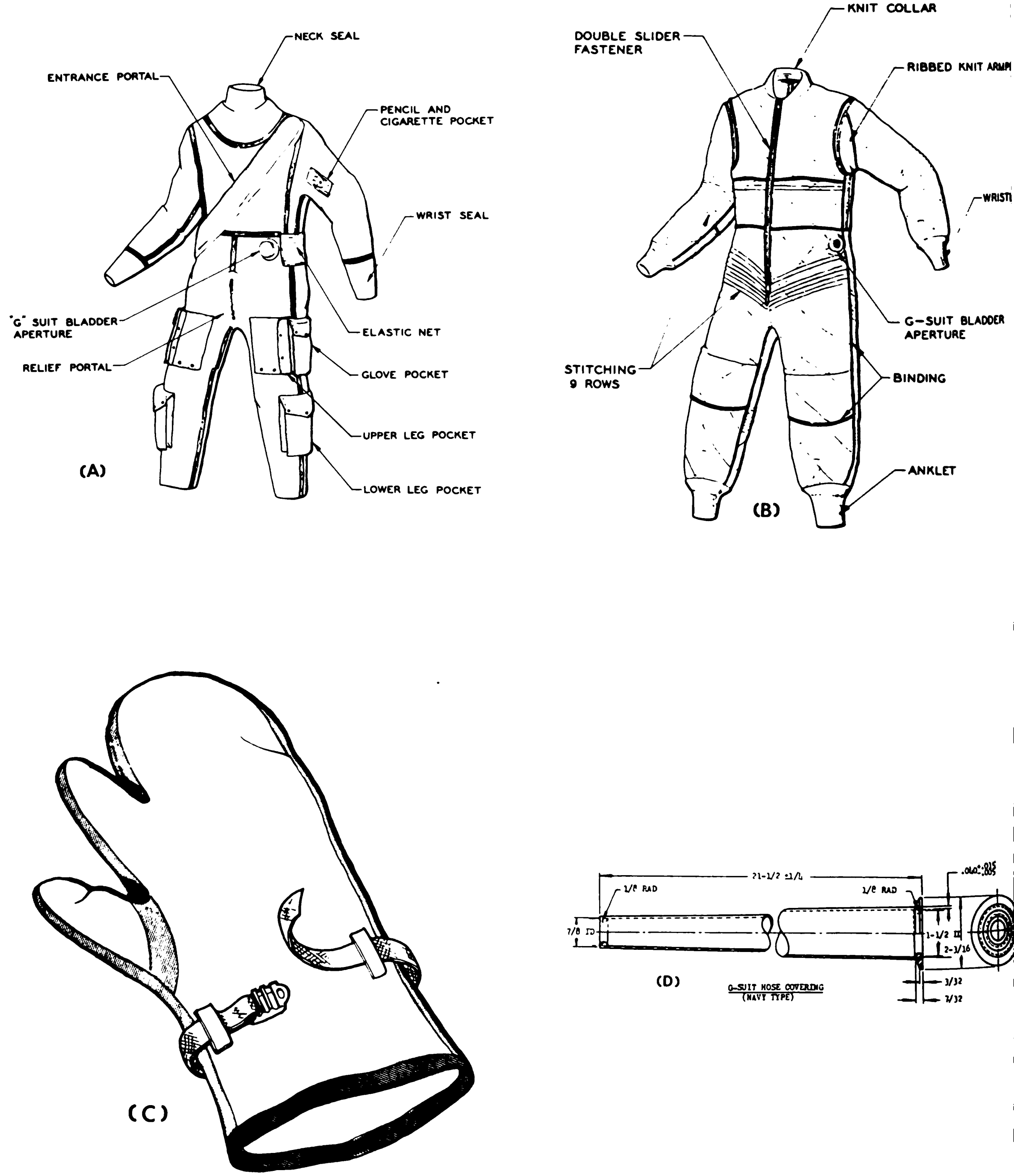
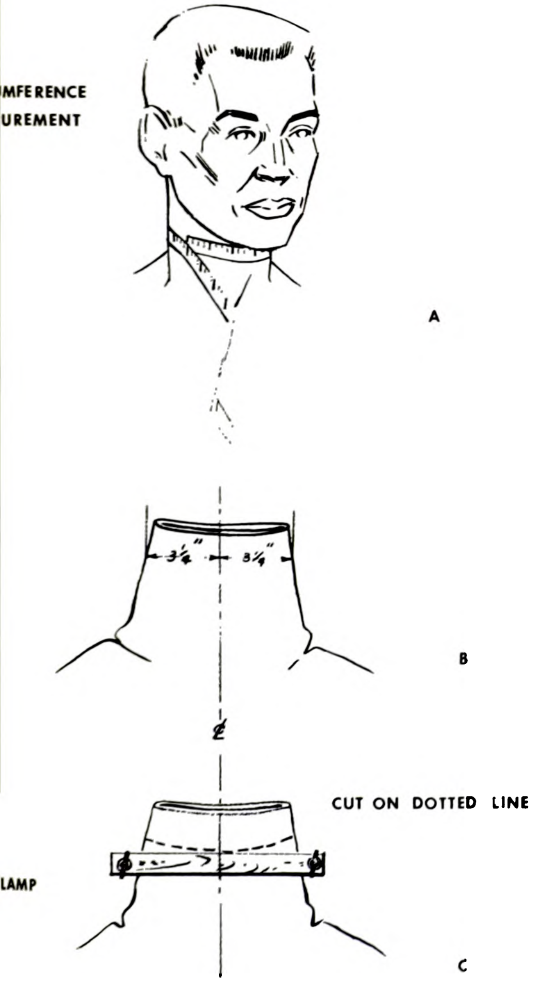


Figure 14-20.—Mk 4 constant wear antiexposure suit.



igure 14-21.—Steps in fitting and marking neck seal.

11. Use the appropriate size scissors, which st be sharp to avoid nicking. When cutting, e precautions to prevent the bottom edge m slipping away from the line of cut. Any nple clamping device will hold the edges ether firmly. As for measuring and marking wrist seals, be guided by the centerlines of sleeves and the original edge line.

FITTING AND ATTACHING BOOTS.—The ocedure for fitting the boots is as follows:

1. While wearing the inner liner and outer it, the individual to be fitted should assume sitting position, adjusting the lower section of suit as he would if wearing conventional ousers. This permits a sufficient amount of ck in the knee area. Placing the boot on the floor adjacent to the leg, mark the suit leg 2 1/2 inches below the point where it overlaps the top of the boot. Remove the suit, flatten the leg and continue this mark across the leg. Cut along this line to remove excess material. Flatten the portion of the leg which was removed as excess and lay on top of the remaining leg so that both bottoms meet; mark the suit leg at the top of this material and cut off the marked area so that both legs of the suit are of the same length. (See fig. 14-22.)

At this point, too much emphasis cannot be placed on the importance of allowing enough slack in the legs of the suit. An insufficient measurement will lead to restricted movements; the restricted movements will strain the material and seams and will damage the suit. IT IS BETTER TO HAVE TOO MUCH SLACK THAN NOT ENOUGH. With the suit off, place a 5 1/2-inch diameter cylinder in a leg deep enough so that the bottom edge coincides with the mark just made during the stretch. Complete the cutting mark around the leg, using the bottom edge of the cylinder as a guide. Do not make a lopsided mark. If the mark on the inside of the leg is lower than that on the outside, the boot may be cemented to the suit leg at a rakish

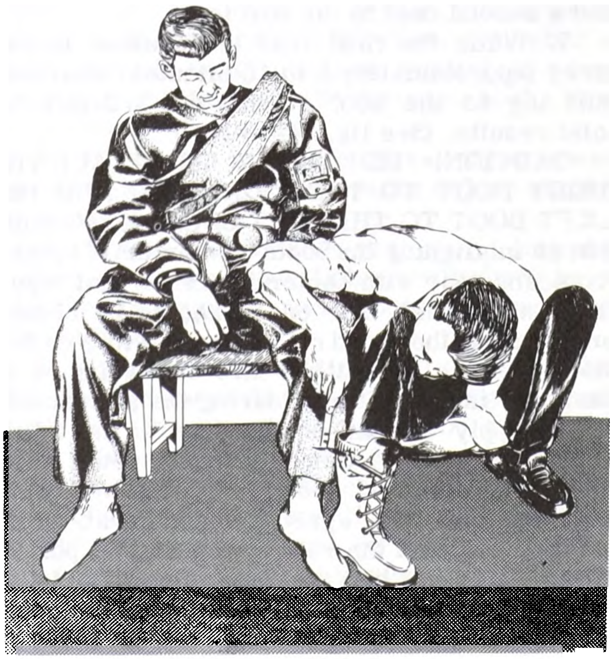


Figure 14-22.—Measuring leg length for fitting the boot.

angle. This can be avoided in the beginning by he application of a number of commonsense nethods. During the stretching period of the itting, mark the inside of the leg as well as the outside, using the boot edge as a reference.

If an inside leg mark was not made during he fitting, rather than have the man put the suit on for a second time, measure up from the bottom edge of the leg the same distance as the outside mark indicates to obtain a straight cutting line. However, if the bottom edge of the leg n question is not in an even condition (lopsided n the beginning), the suit will have to be put on again and an inside leg mark made relative to he top edge of the boot.

2. Cut off the excess material from each eg.

3. Insert a tapered block in the top of each boot, tapered end down, until a snug fit is obtained.

4. Coat the upper 1 1/2-inch portion of the boot exterior with adhesive. (See fig. 14-23 (A).) When dry, apply a second coat, making certain no adhesive is allowed to remain on the blocks.

5. Make a 3 1/2-inch temporary cuff on the suit leg, and apply a coat of adhesive on the RUBBER SIDE for a distance of 1 1/2 inches from the bottom. (See fig. 14-23 (B).)

6. When the adhesive on the boot and suit leg is dry, apply a third coat on the boot top and a second coat to the suit leg.

7. While the final coat of adhesive is still tacky (approximately 8 to 10 minutes) attach the suit leg to the boot so that a 1 1/2-inch lap oint results. (See fig. 14-23 (C).)

CAUTION: BE CERTAIN TO ATTACH THE RIGHT BOOT TO THE RIGHT LEG AND THE LEFT BOOT TO THE LEFT LEG. Use reference marks in aligning the boots (centerline of boots—front and rear with centerline of the suit legs—front and rear). All edges should be closed, pressed together, and rolled firmly with a roller. Make certain that there are no wrinkles or channels in the material during the attachment.

8. Apply a coat of adhesive to the fabric surface to that portion of the side seam which s to be overlapped. (See fig. 14-24.) When this coat becomes dry, apply a second coat. At the same time, coat the rubber side of that portion of the side seam that overlaps. (See fig. 14-24.) After approximately a half hour, coat both surfaces again. When these become tacky, join the side seam and roll firmly, backing the seam with he hand. Make certain that there are no wrinkles or channels in the material of the seam.

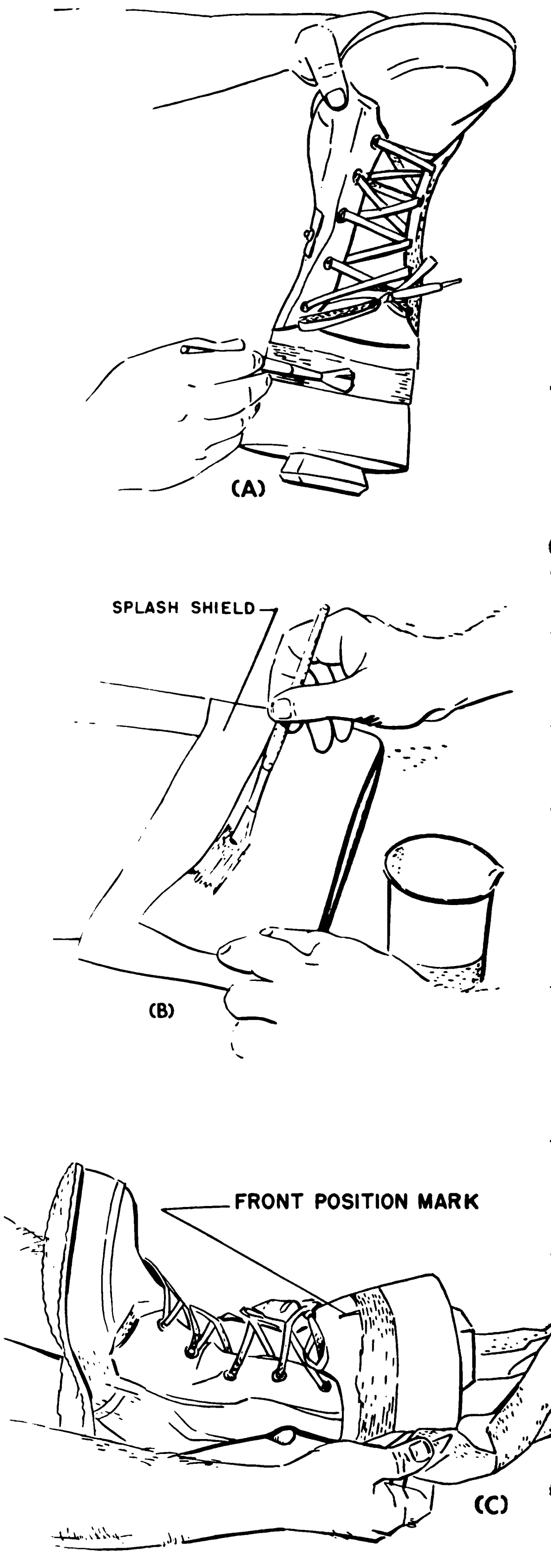


Figure 14-23.—Steps in attaching the boot

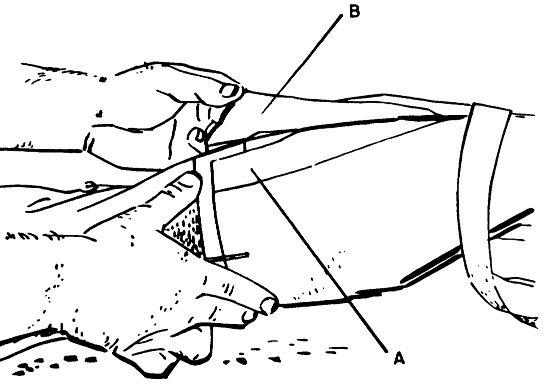


Figure 14-24.—Closing the side seam.

. Apply a coat of adhesive to all untapered ns. Apply a second coat to the side seam r the first has dried. When the side seam dried for the second time, apply a third . When the adhesive on the side seam mes tacky, remove the holland cloth from bias tape. Apply the tape to this seam, cutoff the excess amount at the bottom edge of lap joint running around the boot.

10. Apply the second coat to the circum- ntial (around the boots) lap joints, and allow ry. Apply a third coat of adhesive to only lap joint. When this becomes tacky, apply tape, removing the holland cloth. Overlap end of the tape at least three-fourths of an . Use the roller to make a smooth tight sh. Now apply the third and final coat to the umferential joint of the other boot. When coat becomes tacky, tape and roll firmly. fig. 14-25.) Remove the wooden blocks.

11. Allow 1 day for the final curing of the prene liquid cement.

GENERAL CEMENTING PRECAUTIONS.— ell-ventilated working area should be used to mit the adhesive to dry adequately and rapid- To obtain watertight integrity, it is always essary to observe the following rules:

1. Whenever cement is applied to a FABRIC RFACE, three coats must be applied, allowing h coat to dry a half hour before applying the t.

2. Whenever cement is applied to a RUB- RIZED SURFACE, two coats must be applied owing a half hour between coats. The cement y be used as long as it wets the surface or is ishable.

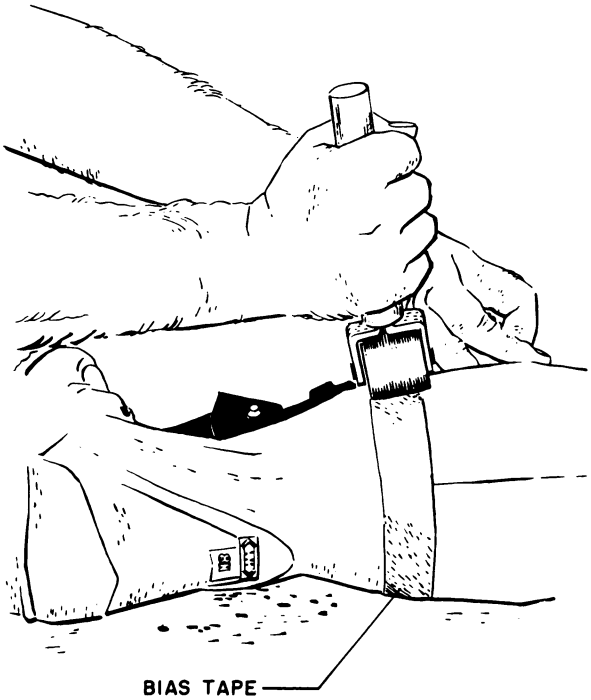


Figure 14-25.—Finishing the boot.

3. NEVER SKIMP ON COATS. The minimum number is set forth in repair instructions; follow them implicity. If the correct number of coats are not used, adequate sealing is never accomplished and the effectiveness of the item is materially decreased.

4. Never join two wet surfaces. Always wait until both surfaces become tacky before placing them together.

5. Always roll finished seams or joints with a slow heavy pressure. Unless rolled properly, adequate adhesion is never obtained between the two surfaces.

6. Whenever separating two surfaces that have been cemented, even for an instant, brush ethyl acetate into the area to be separated.

7. When making repairs on the interior of a suit and upon finding it necessary to work on some other section before the cement extending beyond a closed seam or an applied patch has had a chance to dry thoroughly, powder the area with talc. This will prevent the area from sticking to other parts.

CAUTION: Make certain that talc does not come in contact with areas in need of further repair. TALC WILL NOT TAKE ADHESION.

However, should this occur accidentally, dampen a cloth with ethyl acetate and clean the affected area. Allow it to dry thoroughly before applying more adhesive.

CARE AND MAINTENANCE OF SUITS.— When not in use, antiexposure suits should be kept on hangers in a cool and well-ventilated place. Never store in the direct rays of sunlight. Inspect suits at frequent intervals for damage, expecially in the nonfabric areas. Repair materials are provided in the special repair kits.

In repairing minor holes or tears in the outer suits, obtain the suit fabric and cement from the repair kits. Clean the area to be patched and the rubberized side of the patch with solvent (ethyl acetate or naphtha). After the solvent has evaporated, apply an even coat of adhesive to the surfaces. Allow it to dry and then apply another coat.

When this coat has dried, apply the third coat and wait until it becomes tacky. Then affix the patch, pressing it down and rolling it firmly. Do not attempt to make major repairs, such as the replacement of a section. When a suit is severly damaged, obtain a new suit in exchange.

Suit liners can be dry cleaned; however, when such a method is not available, a "hand-wet-cleaning" procedure may be undertaken. This procedure consists of the following steps:

1. Dip the garment in a tub of water (90°F) to which has been added any neutral synthetic detergent in the proportion of 1 teaspoonful per gallon of water.
2. Gently SQUEEZE OUT excess cleaning solution. (Do not wring it out.)
3. Place the liner on a flat table or surface and rub with a cellulose sponge or soft bristle brush until clean.
4. Rinse in a tub of cold water.
5. Gently squeeze out excess water.
6. Hand on a wooden hanger so that the liner is suspended by the shoulders and let it dry thoroughly. Do not spin-dry in a machine. Never dry the liner with a heating device.
7. Do not iron or press.

Quick-Donning Antiexposure Coverall

The quick-donning antiexposure coverall provides protection against cold water. This suit is constructed of a lightweight waterproof material, and is designed to be put on easily and quickly before landings at sea.

A suit consists of a single-piece coveral type garment with attached hood which envelope the body. The face is the only part left uncovere Mittens are stored in the pockets to provi protection for the hands. The suits are all t same size, and are packaged or folded in co venient carrying pouches for easy stowage aircraft. (See fig. 14-26.)

USE OF THE SUIT.—A BuWeps directi lists the areas of the globe where the quic donning suit should be made available for us

When it is necessary to abandon an aircra while over water, the quick-donning exposu suit should be put on over the flying clothe but under the lifevest and parachute harnes

The hood of the suit is made with a sufficie fullness so that it can be worn over the headgea Use of the hood is optional, as the suit is wate tight whether the hood is worn over the head left folded under the neck closure.

The mittens are normally worn after boar ing the liferaft. They will provide protecti against the cold even though wet.

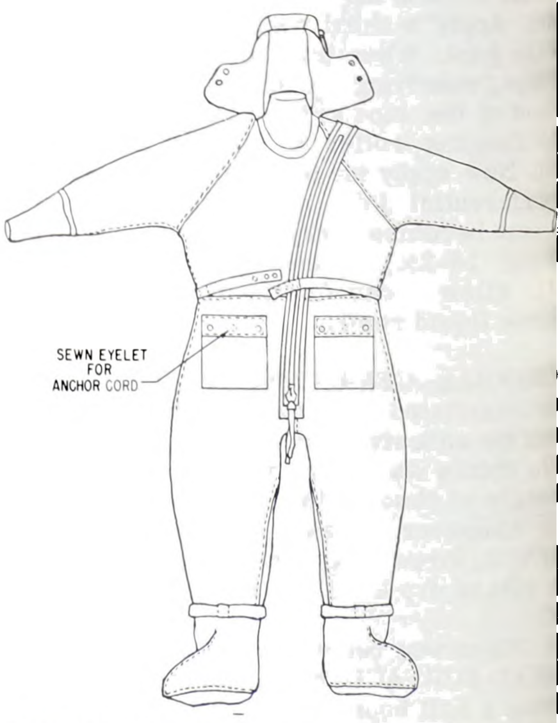


Figure 14-26.—Quick-donning antiexposur coverall.

EARING INSTRUCTIONS.—The steps listed outline the procedures for donning the suit:

Exercise caution when putting on the suit. not damage it by snagging, tearing, or uring.

Remove the suit from the container and l.

Grasp it by the hip section and put the into the boots. Then pull the suit on over oulders while extending each arm, in turn, gh the sleeve openings.

Pull the neck seal over the head.

Adjust the neck properly. Do not allow ndergarments to protrude between the seal and neck as this will prevent a ight, airtight seal.

Close the watertight slide fastener.

After closing the slide fastener, the pped air should be vented out through the pening.

hen contacting the water, jump in feet with the arms close to the sides of the or held together over the head.

SPECTION.—To prolong the life of the suit aintain its reliability, inspect each garment to issue and every 60 days thereafter. inspection rules follow:

Inspect for cracks, tears, holes, and seam ration; defective snap fasteners, buckles, fastener, webbings; and deterioration from gn substances.

Make all inspections on a smooth surface, from harmful agents.

Defective suits are returned to overhaul ities for repair.

VESTS AND PRESERVERS

Lifevest

he Mk 2 pneumatic lifevest was designed e comfortable when worn in flight. To mplish this, it is worn in its deflated state h permits the wearer all the freedom of ment necessary for the performance of duty. When inflated, the vest must give uate and properly distributed buoyancy. inflated, the vest will provide a minimum ancy of 30 pounds.

n important feature of the vest's supporting ties is that its back lobe (head support) tains the wearer's head above the surface the harness suspends him vertically in the r. Since the vest is self-righting, when properly worn and adjusted, it will float the wearer in the safest position with his head out of the water. As a further aid to rescue, small tabs and pockets are fashioned to the vest's front lobes for holding signaling equipment and shark repellent.

The body of the vest is fabricated from polychloroprene coated nylon fabric. The vest is made in three independent compartments. The inside and outside compartments are inflated by carbon dioxide gas, and the middle compartment is inflated orally through an oral inflation valve and tube.

Deflation of the CO_2 compartments can be accomplished only by removing the CO_2 inflator caps. The air compartment is deflated by depressing the oral inflation valve. A nylon webbing harness, complete with adjusting and fastening devices, maintains the vest position on the wearer's body.

BUOYANCY.—When the two CO_2 compartments are inflated (from the standard 8-gram cylinders), the buoyant force (lift) of the vest is 20 pounds. If the center air compartment is also inflated (blown up by mouth), the buoyant force is increased to 30 pounds. This means, in effect, the weight of a person in the water is less than his weight in air by an amount equal to 30 pounds plus the buoyant force of the water.

Since the body, in water, weighs a negligible amount in comparison to its weight in the air, 20 or 30 pounds buoyancy is all that is needed to float the body successfully. It is interesting to note that inflation of the air compartment alone will also produce a 30-pound buoyant effect. A vest inflated to a pressure of 1 1/2 psi is capable of floating a 30-pound steel weight in fresh water.

DESCRIPTION OF MAJOR COMPONENTS.—A brief description of the major components follows:

1. Oral inflator. The oral inflation valve is a self-closing type and is operated by a spring. It can be locked closed by turning a knurled collar until it bears against the depressible valve body.
2. Body harness. The body harness is easily adjusted to fit all personnel. Its hoisting strap, which is part of the harness, can be used as an auxiliary hoisting sling for helicopter rescue purposes.
3. Dye marker pocket. A pocket is provided on the right lobe of the vest for stowing dye markers.

4. Vest light loops. A loop is located on the upper right lobe of the vest for stowing the one-cell life preserver light prior to use. An additional loop is located on the upper left lobe for attachment of the light after the vest has been inflated.

5. Oral inflation tube loop. This is a loop, on the left lobe, used to prevent excessive movement of the oral inflation tube.

6. Equipment pockets. Two pockets, one on each lobe, are used for carrying Mk 13 distress signals and a whistle.

7. CO_2 inflator covers. These are flaps used to cover the CO_2 inflators on each lobe of the vest. They prevent the actuating lanyards and the holders from catching on projections.

8. Pararaft retainer fitting. This fitting is incorporated in the waist strap of the harness for attachment of the snap fitting of either the pararaft or multiplace liferaft retainer lanyards.

9. Snap fastener stud. A stud is located under each lobe of the vest to mate with the fastener components on the harness. They prevent upward movement of the lobes when the vest is worn deflated. When the vest is inflated, the fasteners separate and release the vest lobes permitting them to assume their most effective buoyant positions.

The operation of the CO_2 holder is illustrated in figure 14-27.

ACCESSORIES.—The survival equipment secured to the lifevest is shown in figure 14-28. Use a square knot in tying shark chaser packets to the tabs provided. The single cell light is normally stowed and carried in a loop on the right lobe during flight. After entering the water, the light should be transferred to the loop on the left shoulder. The sharp point of the pin on the light must be blunted and smoothed off BEFORE INSTALLATION to prevent puncturing the vest material.

FITTING.—All lifevests should be individually fitted to allow enough slack in the harness so it will not bind the wearer after inflation. The simple fitting procedure is as follows:

1. Have the wearer put on the vest and secure the harness link fastener, the fasteners which joint the lobes, and the fasteners which hold the lobes to the waist belt.

2. Inflate the vest by mouth to its maximum volume.

3. Adjust the harness adapters to obtain a comfortable snug fit.

4. Remove the vest and deflate by depressin the oral inflator valve.

Unscrew the valve lock, and the vest is read for emergency inflation.

PREFLIGHT INSPECTION.—Every weare must be able to determine the condition of hi lifevest. The following inspection should conducted by the individual prior to every fligh

1. Inspect all exposed metal parts for ev dence of corrosion. If corrosion exists, retu the vest for repair and replace it with one th is satisfactory.

2. Observe the inflator holders and the safe wires which secure the actuating levers in closed position. These should be tied togeth with 0.016-inch copper wire applied to aid preventing accidental discharge.

3. Unscrew the inflator holder caps, one a time, observing the condition of the C cylinders. A punctured seal indicates an emp cylinder. Insert the cylinders in the holders neck-end down. To be actuated, the seal mu be in a contacting position with the piercing pin The holder caps must be screwed down tight and be fitted with gaskets to prevent leakag

4. Examine for snags, tears, abrasions, signs of wear in the vest fabric, seams, a harness.

5. Inventory all emergency equipment, no ing condition and security. Rusty signals shou be replaced, and a cracked whistle is of litt value.

6. Check harness adjustment to insu against binding.

7. Deflate compartments completely. E trapped air expands at altitude and will cau discomfort to the wearer.

PERIODIC INSPECTION.—The following spections are conducted on all Mk 2 life pr servers prior to placing them in service quarterly thereafter.

1. Inspect all fabric and webbing surfa for chafing or fraying; reject any badly w vest.

2. Inspect all exposed metal parts for e dence of corrosion and replace if necessa Insure that the large wire spring clamp t fasteners are properly secured to the vest lo and that a blanket loop is incorporated in waist belt.

3. Inspect security of all equipment ta loops, pockets, and covers.

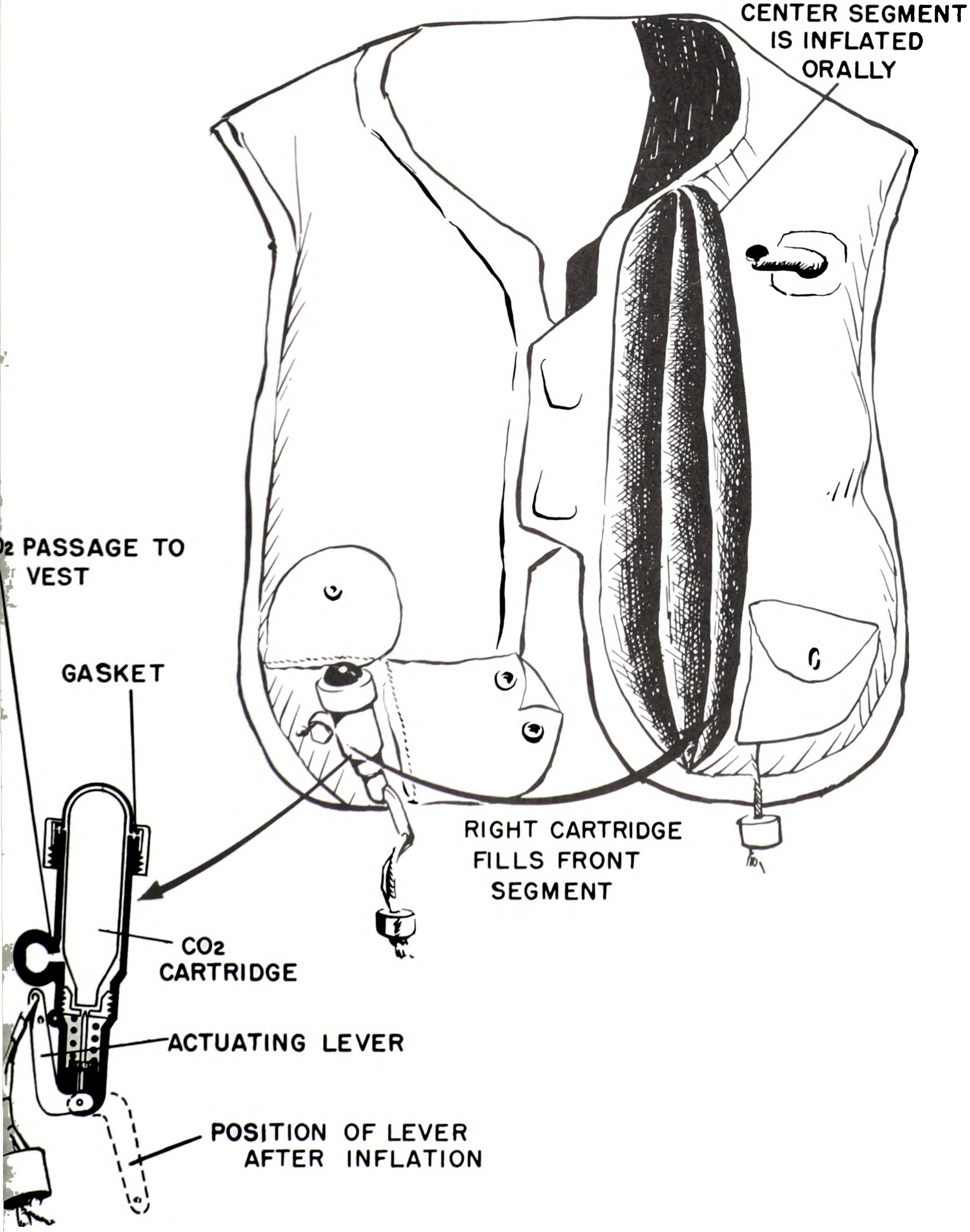

CENTER SEGMENT IS INFLATED ORALLY
$_2$ PASSAGE TO VEST
GASKET
RIGHT CARTRIDGE FILLS FRONT SEGMENT
CO_2 CARTRIDGE
ACTUATING LEVER
POSITION OF LEVER AFTER INFLATION

Figure 14-27.—Operation of CO_2 holder.

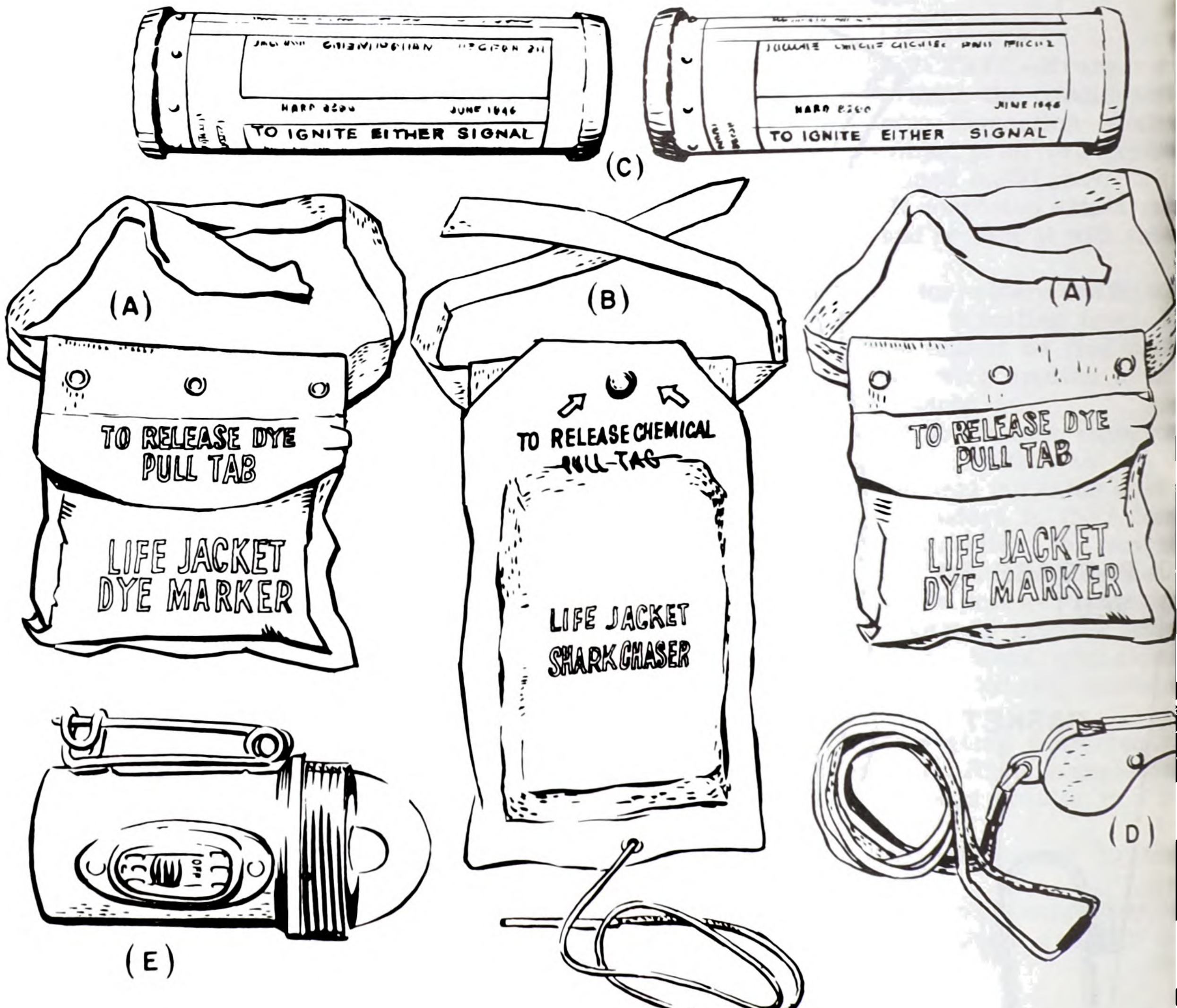


Figure 14-28.—Lifevest equipment. (A) Dye marker packets; (B) shark chaser packet; (C) Mk 13 Mod 0 distress signals; (D) whistle; (E) single cell light.

NOTE: Before making any inspection or doing any maintenance work on the Mk 2 lifevest, refer to and become thoroughly familiar with ACSEB 55-61.

4. Test each compartment individually by inflation with air to a pressure of 2.0 psi, and allow to stand for a minimum of 15 minutes. The pressure is then checked and readjusted if necessary to the original pressure of 2.0 psi. The temperature and barometric pressure are then recorded. At the end of a minimum of 24 hours after the readjustment period, the pr sure is checked and corrected for atmosphe or temperature changes which might have curred during this 24-hour period. The corre pressure must be at least 1.5 psi. The compa ment under test is then deflated and the s test is repeated for each of the other c partments. When testing the CO_2 compartme the CO_2 inflator is removed from the mani and replaced with a check valve conformin MS22023. Any vest having a pressure dro

ss of 0.50 psi must be rejected as
rviceable.
. Remove check valve MS22023 and reinstall
inflator. Replace gaskets on inflator assem-
s shown in figure 14-29.
. Perform functional check by discharging
O$_2$ cylinder into each compartment in the
al manner. Each compartment must inflate
ntly.
. Deflate by removing the holder caps.
ty wire the discharge levers in the closed
tion, ready for service.
. Inflate oral inflation compartment to 4
and apply suction to both CO$_2$ compartments.
. Insert CO$_2$ cylinders in both inflators
replace holder caps.
0. Deflate oral compartment; use suction
p to completely deflate compartment. Leave
inflation valve in unlocked position.

PATCHING.—The application of patches to
ir holes and tears is accomplished as
ows:
1. Cut a scalloped patch of chloroprene-
ted nylon vest fabric large enough to extend
ond the damage for a margin of 1 1/2 inches.
ce the patch in position over the hole and
k around the patch.
2. Clean the marked area and the underside
the patch with aliphatic naphtha (or other
able safety solvent) and allow it to dry.
3. Apply three coats of cement (conforming
the applicable specification adaptable to
oroprene-coated fabrics) to the surface of the
naged area, allowing ample time for each
t to dry.
4. Apply three coats of cement to the inside
the patch, allowing ample time for the first
coats to dry. When the last coat is tacky,
the patch over the tear and roll it down,
ng careful not to trap air between the two
mented surfaces.

SEAMS.—Seams which show signs of opening
ss of adhesion) are repaired in the following
nner:
1. Clean the inside of the opened seam with
chloroprene solvent as recommended by the
ment manufacturer.
2. Thin a small quantity of cement by adding
equal amount of toluene or a suitable thinner
ecified by the manufacturer and mix thorough-
Apply the thinned cement to the washed area
each of the two sides of the seam covering
e entire area as much as possible; allow to dry.

3. Apply three more coats of the thinned cement to each side of the seam and one coat of full strength cement to each side of the seam. Allow sufficient time for each coat to dry.

4. When the last of these coats has become tacky, press the seam together and roll it down firmly, being careful not to trap air between the two cemented surfaces.

5. Next, apply four coats of thinned cement and three coats of full strength cement to the outside of the seam.

6. When the last of these coats has become tacky, fold a piece of tape 1 1/2 inches wide (conforming to the specifications) over the prepared section of the seam with the cemented faces adjoining. Roll the seam to insure the exclusion of air and to obtain a tight bond between surfaces.

CLEANING.—The vest may be cleaned with mild soap and water only, followed by a thorough rinsing and drying. For removing old cement, grease, paint, or similar strains from surface areas, use aliphatic naphtha or other suitable safety solvent. When using solvents for this purpose, exercise caution not to dissolve too much of the rubber coating. Always use solvents in well-ventilated surroundings.

SURVEY.—Lifevests exceeding a 5-year storage or service life are surveyed and replaced.

Mark 3C Life Preserver

The Mk 3C is a self-righting life preserver offering a minimum of 60 pounds buoyancy and capable of supporting a survivor vertically in the water. It consists of two independent floatation cells. These cells are made of chloroprene-coated nylon cloth and joined together by gussets. (See fig. 14-30.)

Each cell is equipped with its own oral and mechanical inflation system. They are inflated orally by turning the knurled sleeve down, pressing in on the mouthpiece and blowing into the inflation tube. Releasing the pressure on the mouthpiece closes the self-closing valve. Upon completion of the inflation, the knurled sleeve should be turned up against the mouthpiece to lock the valve in the closed position.

The mechanical inflation assembly consists of an inflation valve, a check valve, and a 28-gram CO$_2$ cylinder. A lanyard with a toggle is placed within easy reach of the wearer.

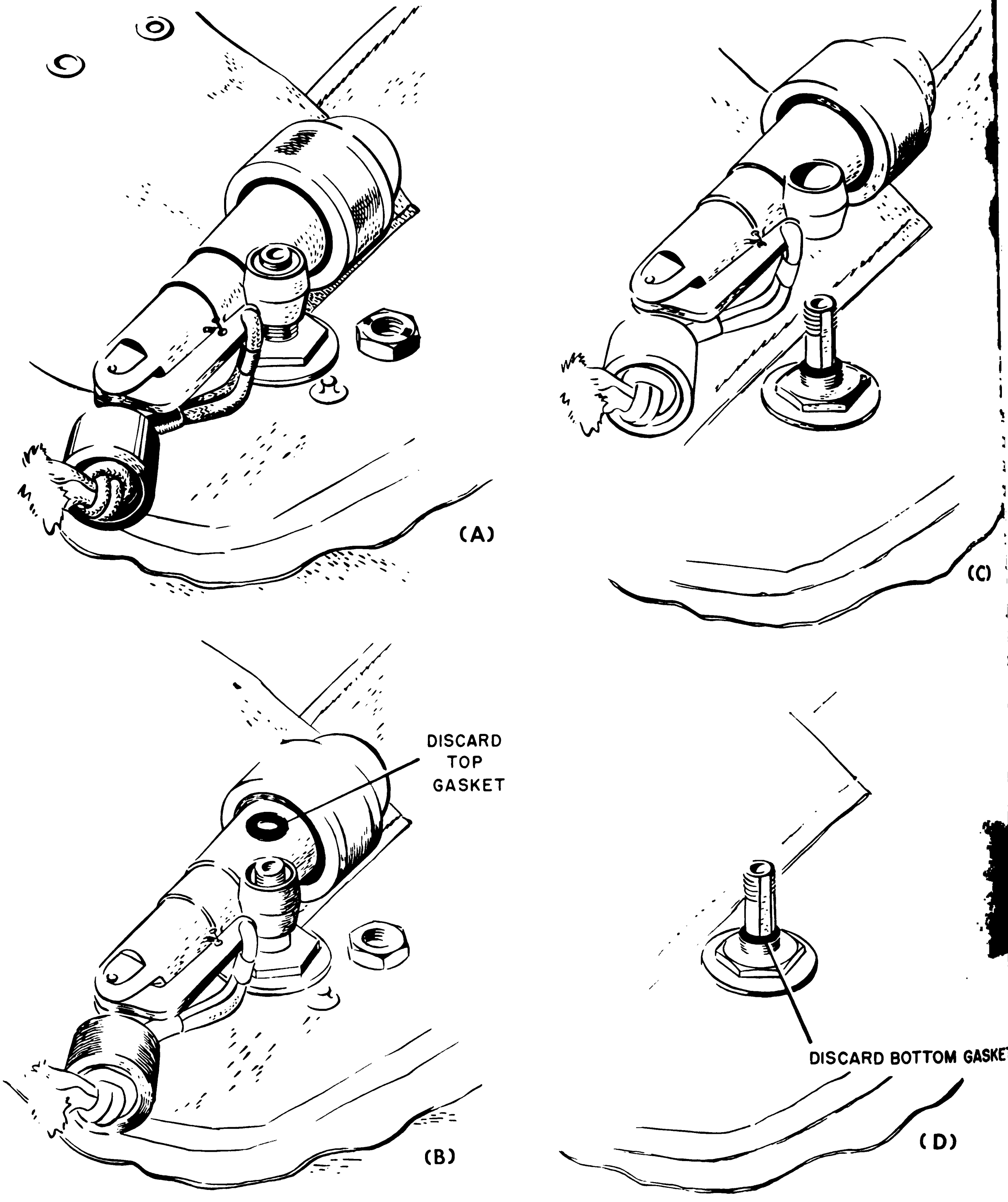
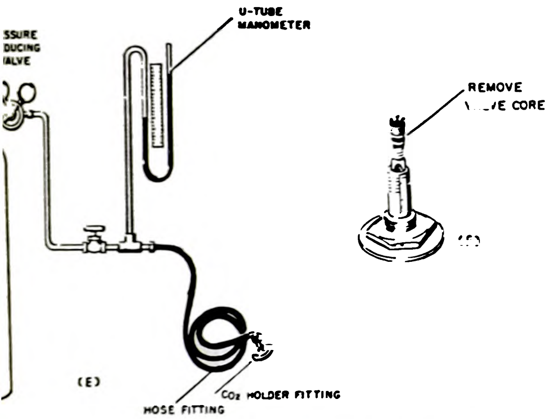


Figure 14-29.—Replacement of gaskets. (A) Remove hexagonal capnut which secures CO_2 inflator to manifold; (B) remove and discard top gasket. (C) Remove CO_2 inflator; (D) remove and discard bottom gasket.



igure 14-29.—Replacement of gaskets—continued. (E) Install valve core in threaded manifold and inflate CO_2 compartments; (F) upon completion of test, remove the valve core. NOTE: Upon removal of valve core: (1) install new bottom gasket (9/32-inch ID); (2) replace CO_2 inflator; (3) install new top gasket (11/32-inch ID); and (4) reinstall assembly and secure hexagon capnut.

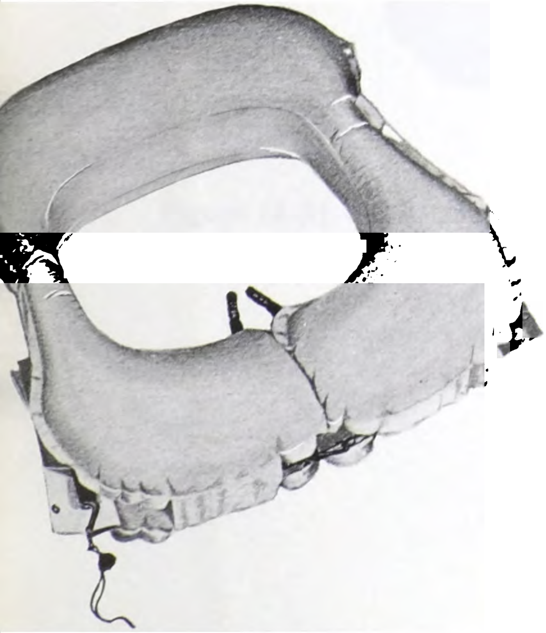


Figure 14-30.—Mk 3C life preserver.

The deflated life preserver is contained in a carrying case of heavy nylon fabric. This case has pockets attached for two Mk 13 Mod 0 distress signals and a means of attaching two dye markers.

FITTING. Fitting the Mk 3C is a comparatively simple procedure. With the markings "right" and "left" on the outside, don the preserver as a belt and join the two snaps in the front. This will secure the case snugly and comfortably around the waist. An adjustment band is provided on the back of the carrying case to facilitate individual adjustment.

INSPECTION.—All Mk 3C preservers are inspected prior to being placed in service and quarterly thereafter. This inspection is performed as follows:

Visually inspect all fabric and webbing for chafing or fraying, all metal parts for corrosion, and all equipment pockets and loops for strength of attachment.

Before each flight, examine the case for signs of excessive wear, and check all metal parts for corrosion.

TESTS.—The CO_2 cylinders are tested before installation by weighing to insure that they are adequately charged. The minimum weight for the type II (28 to 31 gram) cylinder is 1 gram less than the gross weight stamped on the cylinder.

For the leakage test, remove the valve core from the stem and replace with the low pressure cap MS22023. Inflate each cell to 2.0 psi and allow to stand a minimum of 15 minutes. Check the pressure and adjust if necessary to 2.0 psi. Record the temperature and pressure. At the end of 24 hours minimum, the pressure is read and corrected in accordance with ACSEB 15-60. Any preserver showing a corrected pressure of less than 1.5 psi is rejected as unserviceable.

The functioning of each preserver is determined by discharging a CO_2 cylinder into each of the flotation cells. Deflation of the cells may be accomplished by unlocking the oral inflation valves and allowing discharge through the oral inflation valves.

MAINTENANCE.—Before attempting to repack a Mk 3C life preserver, make sure that all checks and tests have been properly made and that the cells are completely deflated. Lay the empty carrying case on a flat surface with the labeled right side on your right side as you face the case. Insert the cells through the retaining webbing loops as shown in figure 14-31.

Fold the rear section of the cells forward to approximately the same width as the adjustment envelope of the carrying case. Lay the folded section of the cells in the adjustment envelope and fold the flaps of the envelope over the cells. (See fig. 14-31.) Hold the adjustment envelope closed and fold forward. Fold the flaps over the adjustment envelope and engage one snap on each side of center of the envelope.

Attach dye markers and insert distress signals as shown in figure 14-32.

Insert CO_2 cylinder through retainer loop and screw into inflator assembly making sure that antichafe protector (fig. 14-33) is in place; close protective cover and snap. Place inflator assembly in retainer strap and snap retainer to case. Close two additional snaps on each side of center.

Tuck in cells and stow oral inflation tube. CAUTION: Stow inflation tube without any sharp bends.

Insert a cord through the securing loop
pull the securing loop through the eyelets
each flap, progressing as shown in fig
14-34. Complete passing of securing loop thro
flap eyelets, insert nylon pin, and remove co

The completely packed Mk 3C life preser
is shown in figure 14-35.

Mk 4 Life Preserver

The Mk 4 life preserver (fig. 14-36)
designed expressly for use with the Mk 4
pressure suit. Although the materials used
manufacturing, as well as the design configur
tion differ, the function of the Mk 4 is the sa
as the Mk 2 and the Mk 3C.

The Mk 4 should be inflated periodically
accordance with current directives and check
for leaks. Remove as much air as possible aft
these tests to prevent unnecessary inflation
altitude from expansion of the residual
trapped in the inflation compartments. Routi
care and maintenance is the same as for oth
life preservers.

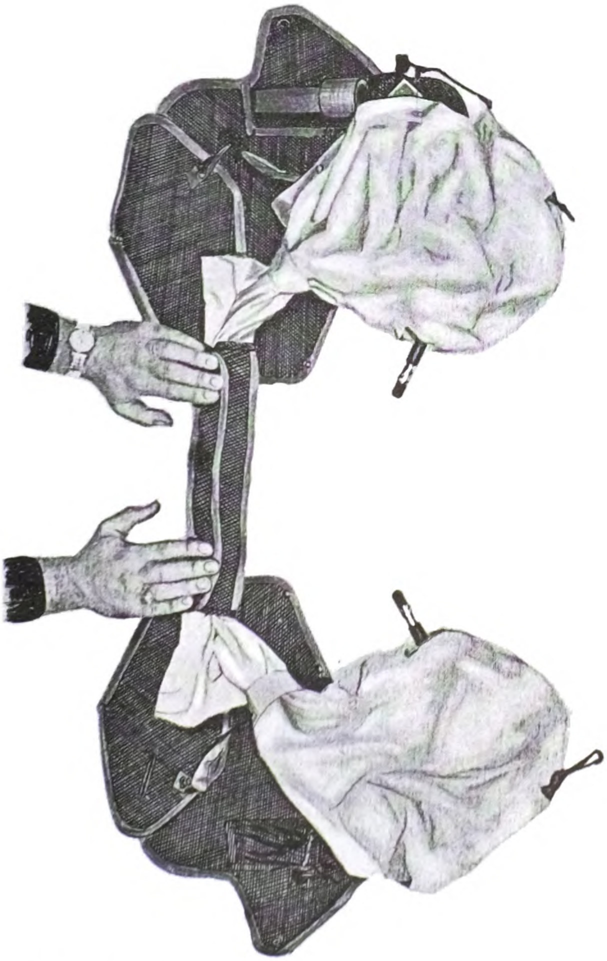


Figure 14-31.—Mk 3C partially packed showing cells inserted through loops and flaps of the adjustment envelope folded over the cells.

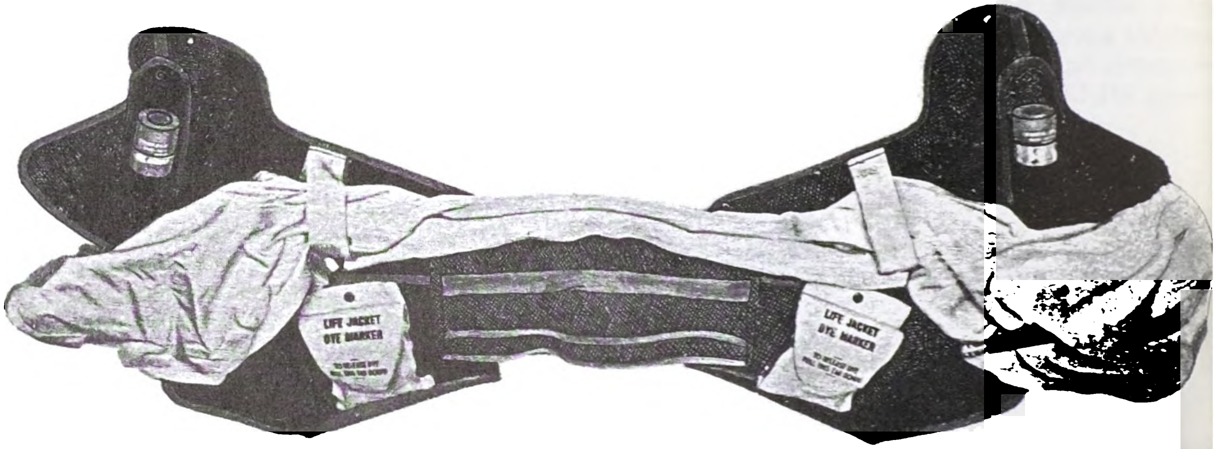


Figure 14-32.—Dye marker and distress signal attachment.

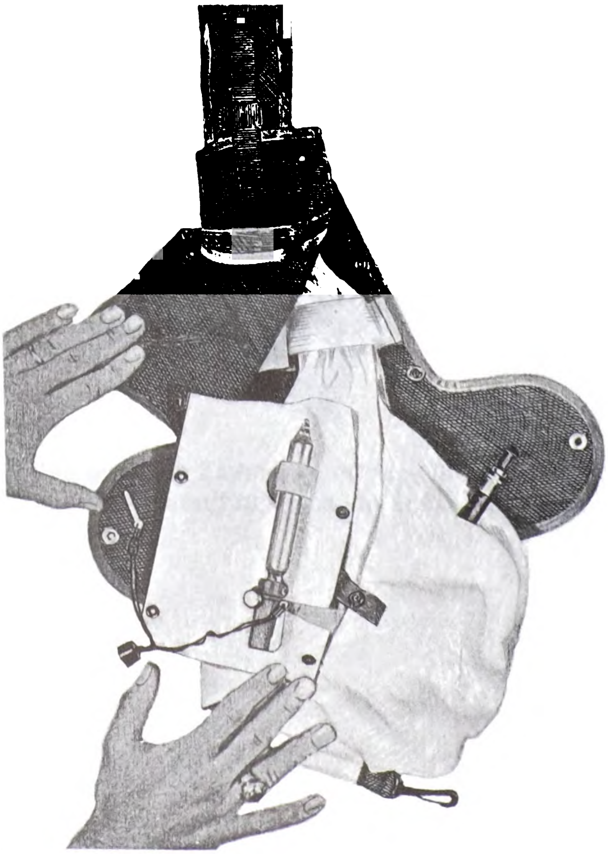


Figure 14-33.—Antichafe protector in place and CO_2 cylinder properly installed.

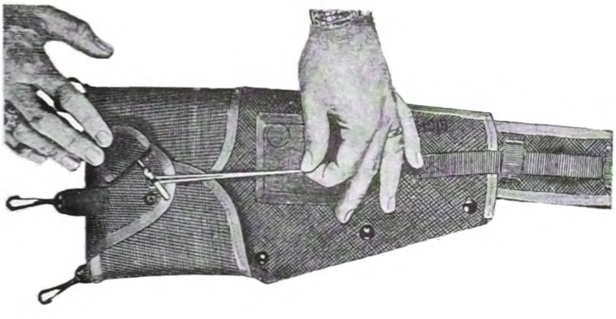


Figure 14-34.—Cord and nylon pin inserted through securing loop.

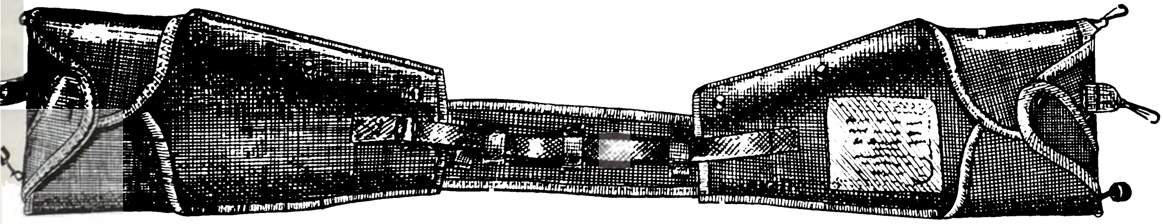


Figure 14-35. Completely packed Mk 3C.

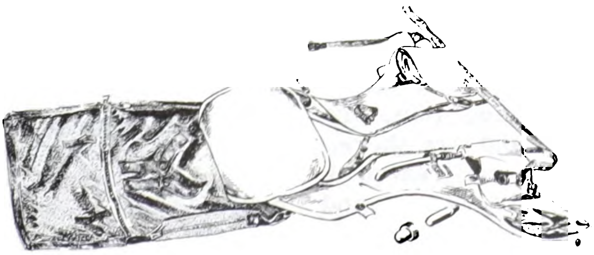


Figure 14-36.—Mk 4 life preserver.

CHAPTER 15

STANDARD LIFERAFTS AND EQUIPMENT

Naval aircraft making operational flights over water are required to carry rafts which will accommodate all of the assigned crew plus passengers. These rafts are manufactured in various sizes and configurations to meet the demands of all types of aircraft.

Pneumatic rafts are compact assemblies, capable of being stowed in a small area. They should be stowed so as to be readily accessible, preferably near an emergency exit. Never stow a raft under other equipment or cargo or near batteries. Protect them from heaters, engines, auxiliary power units, electronic tubes, and other sources of heat.

If the aircraft flight manual designates a storage place for rafts, this space should be used, unless otherwise directed by competent authority. Whenever possible, rafts should be stowed in the same place in all aircraft of the same model. This will enable the crewmen to become familiar with their location and thus avoid confusion in the event of a ditching. Rafts are made of rubber-coated fabric and are therefore susceptible to damage from maltreatment. However, they are surprisingly strong and durable, and have tenacious stability when afloat at sea.

It is the responsibility of the Parachute Rigger to inspect, pack, and maintain all of the various types of rafts and related equipment.

MULTIPLACE RAFTS

All multiplace rafts are of the same construction, but vary in size and in the quantity of equipment they carry. As a safety measure they have separate air compartments. This enables the raft to maintain its buoyancy, even in the event of a puncture of one of its compartments. In the Mk 4, for example, there are three air compartments--two automatically inflated by CO_2 and a seat compartment which
can be inflated with a hand pump. The
automatically inflated compartments are sep
rated by a vertical bulkhead amidships.

Each raft is enclosed in a carrying ca
secured with snap fasteners or a ripc
arrangement. As the raft inflates, the case
forced apart, and the inflated raft emerges fr
the case. The case may be used as an additio
drogue or sea anchor.

CONSTRUCTION

The body of the raft consists of an encircl
buoyant tube and a fabric bottom. All rafts
manufactured in sections to provide the spe
fied shape. The fabric bottom of the raf
applied without tension across the enclos
formed by the flotation tube and is attac
securely to the underside, extending 4 inc
beyond the centerline, all around the tube. Al
this attaching line different widths of tape
used for reinforcing and finishing-off purpo

Seams

All seams and attachments are secure
self-curing rubber cement. No stitches are
in the seams or through the fabric of
compartment. However, sewing is permitte
the construction of patches, oarlocks, di
flap seats, cylinder carriers, lifeline suppo
handles, and pockets.

The minimum overlap for seams is th
fourths of an inch (+1/4 - 0 inch). They are
inforced both on the inside and on the out
with type R tape (1 1/4 inch wide). The tap
applied in such a way that an equal amou
width is on each side of the seam edge whi
covers. The cement is applied in a stra
line, parallel to the edges of the tape, and
tends approximately one-eight inch beyond
tape edges.

eads

e flotation tube is separated into two
rtments by internal vertical bulkheads.
eads are constructed of type N rubberized
and are either hemispherical or conical
sign. The bulkheads are installed amid-
equidistant from the bow and stern, in
a way that the volume of the two com-
ents is equal. The bulkhead-to-tube attach-
is reinforced on one side with type R tape,
n the other side with a hinge of wider type
e. A 4-inch-diameter patch of type O fabric
stalled on the bulkhead for protection
st abrasion by the manifold diffusers when
ft is packed in the carrying case.

the Mk 20 raft the internal bulkheads are
oned on each side of the boarding stations.
provides a section which is deflated and
s ease in boarding the raft.

able Seats

n inflatable seat is installed in certain
place rafts, for example, the Mk 4, Mk 7 and
2A-1. These seats are circular in shape
re constructed of type O fabric. The ends
e seat are tailored to fit the curvature of
flotation tube. Each end of the seat is
ed with type N fabric, making the seat an
endent air chamber before it is installed.
e seats are independently inflated by a
, using the hand pump provided.

he seat is attached to the bottom of the
with a hinge tape of type N fabric, extend-
the length of the seat tube. This method
tachment allows for expansion, and prevents
e stresses between the bottom of the raft
the seat.

ocks

ome rafts are outfitted with oarlocks. The
ock consists of seven plies of type O fabric
ented together. The two outside plies on
side are folded outward at right angles to
n a base. The fold of the outer plies, which
ns the top of the base, is not less than
2 inches wide; whereas the fold of the
r plies, which forms the bottom of the base,
ot less than 1 inch wide. The outside edge
he oarlock is taped with type R tape to make
nooth surface.

A patch of type O fabric of sufficient size
xtend 1 inch beyond each end of the oarlock base, and containing a slot through which the upright section of the oarlock passes, can be sewed or cemented securely to the flotation tube. This patch, which supports the oarlock, extends 6 inches beyond the base, and protects the flotation tube from the chafing action of the oars.

A reinforcing disc of type O fabric is sewed or cemented to the patch at each end of its slot. A No. 11 brass grommet is set in each oarlock, located so that the bottom edge of the hole is 1 inch above the flotation tube. Each oarlock is attached to the flotation tube outside the top centerline in such a position that the upright portion, containing the grommet, is at an angle from the vertical, inclined away from the centerline. An oarlock is also attached to the top of the flotation tube at the stern so that an oar can be inserted through the oarlock and be used as a rudder.

NOTE: All multiplace liferafts currently under procurement and those for future procurement are made from a rubber impregnated nylon fabric instead of the fabrics previously mentioned for those rafts manufactured in the past.

Mast Holder

One mast holder consisting of an upper and lower structure is constructed in each raft. The upper part of the mast holder consists of an oarlock attached in a horizontal position approximately 3 inches above the inside centerline of the flotation tube. The lower part consists of a socket made of two plies of type O fabric and is 4 inches in length. The socket is cemented to a 4-inch diameter patch consisting of two plies of type O fabric. The patch is then cemented to the raft bottom directly in line with the hole contained in the upper part. Together, these mast holder parts can support an oar handle in the vertical position. The handle passing through the upper hole in the oarlock terminates in the socket.

The Mk 20 liferaft has two mast sockets. They are cemented to the center of the raft floor on opposite sides. They differ from the mast holders of the other types of rafts in that the upper section (oarlock) is not necessary.

Supply Pocket

Each Mk 4 and Mk 7 raft has a supply pocket which measures approximately 8 x 8 x 2 inches.

It is attached to the tube surface inside the raft by stitching the pocket to a patch and cementing the patch to the tube. Each pocket should be clearly and indelibly marked SUPPLY POCKET in 1/2-inch letters.

Supply Pocket and Bailer

Another type of supply pocket is attached to each multiplace raft except the Mk 20. This pocket measures 10 x 10 x 2 inches and is constructed from type O fabric. The pocket is closed by means of a slide fastener across the top, which is sealed with tape after the equipment is packed. A loop of semihard spring wire is contained in the seam around the slide fastener so the pocket may be fashioned into a bailing container.

The pocket is secured to the flotation tube by means of two large curtain type fasteners so that it may be detached. To avoid loss of the pocket, it is secured to the lifeline by a 5-foot length of type III suspension nylon line. The words SUPPLIES AND BAILER are stenciled in 1/2-inch letters on the pocket. Below this, stenciled in 1/4-inch letters, are the words

KNIFE, SIGNALING MIRROR,
WHISTLE, LINE, COMPASS,
and MAST CLAMP.

Cylinder Carrier

One cylinder carrier, suitable for holding the CO_2 cylinder securely in position, is provided with each raft. The carriers are constructed and located in accordance with applicable standard drawings for each particular raft.

Lifeline

A nylon lifeline encircles the perimeter of the raft. The line is attached to the raft by means of lifeline loops or supports. The lifeline is secured to the supports with overhand knots to prevent the line from running free through the supports. A 4-inch slack in the line is allowed between the supports.

The supports are constructed of type III, 1-inch-wide, nylon tape. A strip of webbing 5 inches long is threaded through a slot in a 3-inch-diameter type O fabric disc, forming a loop 1 inch long. The loose ends are securely stitched to the disc and two rows of stitching are made through the base of the webbing This assembly is then cemented to the outside quarter of the flotation tube mi between the horizontal and vertical center of the tube. A type O fabric disc, 5 1/2-in in diameter, with a slot in the center is cemented over the loop assembly to the f tion tube. Each completed lifeline patch withstand a 200-pound pull exerted in a di tion perpendicular to the base of the patch.

Righting Handles

Each raft has righting handles. Each h is constructed of an 11-inch length of typ 1-inch nylon tape. The handle is covered outer patch of type O fabric extending be the edge of the disc and securely cement the raft. A 1-inch slack is allowed in the at ment to make them easier to grasp.

Boarding Handles

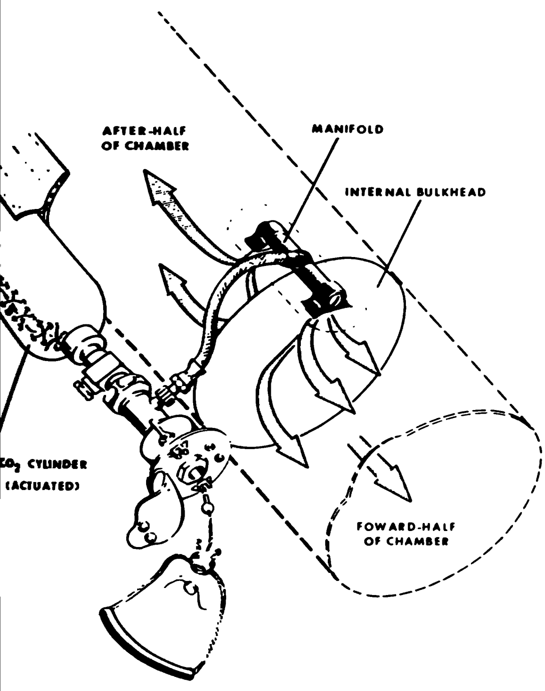
Each raft has boarding handles. These boa ing handles are constructed in the same ma as the righting handles. They are attached to raft in accordance with the applicable drawi

Topping-Off Valves

A topping-off valve is installed in flotation tube compartment of the raft. topping-off valve is used for hand infl purposes in conjunction with the hand pu also serves as a means for relieving internal tube pressures that may possibly up during hot sunny days. Both valves installed on the same side of the raft, on top inside quarter midway between the verti and horizontal centerline 4 inches from vertical (internal) bulkhead.

Stenciled instructions relative to topping and deflation of the raft are applied on the flotation tube adjacent to the topping-off val Appearing in 1/4-inch black letters, the instr tions are stenciled on a white rubber patc follows:

> TO INFLATE COMPARTMENTS MANUALLY: Attach hand pump to valve cap, unscrew cap 1 1/2 turns to the right and then pump to inflate. When desired pressure is attained, retighten valve cap and remove pump.
>
> TO DECREASE PRESSURE: Open valve 1 1/2 turns to the right and bleed.



ire 15-1.—Multiplace raft inflation system.

tion System

he valve of the CO_2 cylinder is threaded the coupling nut of the manifold. Since lplace rafts are constructed with internal eads, the purpose of the manifold is to ide a common means of directing and sing the flow of gas from the actuated cylinder to each of the separate compartments at the same time. To do this the manifold outlets must bridge the internal bulkhead over which they are mounted. Figure 15-1 illustrates the operation of a raft inflation system.

All the exposed metal surfaces of the inflation system which might chafe the raft fabric while in a packed condition should be suitably and securely covered with cheesecloth or suitable scrap cloth.

MK 4 RAFT

The Mk 4 raft is designed to accomodate four men plus sufficient emergency and accessory equipment to keep them alive for 1 week at sea. It is 9 feet 2 inches long and 5 feet wide. Complete with all equipment and the CO_2 inflation system, its weight is 86 pounds. The CO_2 cylinder has an internal volume of 147 cubic inches and the raft is inflated to a pressure of 1 psi by a CO_2 charge of 3.25 pounds. This pressure gives it a buoyant capacity of 1,800 pounds.

EQUIPMENT

The equipment carried in the Mk 4 raft differs from that carried in other rafts basically in the quantity carried, with a few minor exceptions. Therefore, all emergency and accessory equipment is covered here. Quantities for each individual raft are listed in tables 15-1 and 15-2.

Table 15-1.—Emergency Equipment.

Description of items	Mk 4	AR-4	Mk 7	Mk 12A-1	Mk 20
water stowage	4	4	7	12	12
lter kit, sea water, Mk 2	4	4	7	12	12
: still	4	4	7	12	12
first aid	1	1	1	1	1
nent, sunburn	1	1	1	2	3
ms, emergency Food packet, aircraft)	4	4	7	 12	 20

Table 15-2.—Accessory equipment.

Description of item	Mk 4	AR-4	Mk 7	Mk 12A-1	Mk
Bed, hammock (Mk 4 size)	1	1			
(Mk 7 size)			2		
(Mk 12A-1 size)				2	
Compass, card type	1	1	1	1	1
Cord, nylon	100 ft	100 ft	100 ft	200 ft	200
Jackknife (general purpose) MIL-K-818	1	1	1	1	1
Marker, sea, fluorescein dye	6	6	6	6	12
Mirror, signaling	1	1	1	2	2
Oar, metal, sectional MIL-O-8626					
(MS 26529-2)	3	3	3		
(MS 26529-12)	1	1	1		
(MS 26529-13)				2	
(MS 26529-14)				3	
(MS 26529-15)				2	
Paulins, lifesaving					
(Mk 4 size)	1	1			
(Mk 7 size)			1	1	
Pump, hand air	1	1	1	2	1
Signal, distress, day and night Mk 13 Mod 0.	6	6	6	9	10
Reflector, corner or radio set AN/PRC-17, or PRC-32	1	1	1	1	1
Sponge, bailing	2	2	2	2	2
Bucket, bailing				2	1
Ground/Air emergency code (NavAer 00-25-513)				2	
Lamp assembly, flashlight (type A-9)	1	1	1	1	1
Whistle	1	1	1	1	

ree complete oars and one additional n are supplied with each raft. These oars threefold purpose. They may be used for g or paddling, as reflecting blades for fication purposes in night rescue, and in ng combinations of length as a mast for g a shelter or in mounting a radar tor.

e oars for the Mk 4 rafts are approximately t long; whereas the oars for larger size are approximately 6 feet long. The pneu- raft sectional oar is shown in figure 15-2. ars are constructed from aluminum alloy, he paddle blade is coated with a retro- ctive material for night reflective pur- . Oars are stored in the accessories iner of the respective rafts.

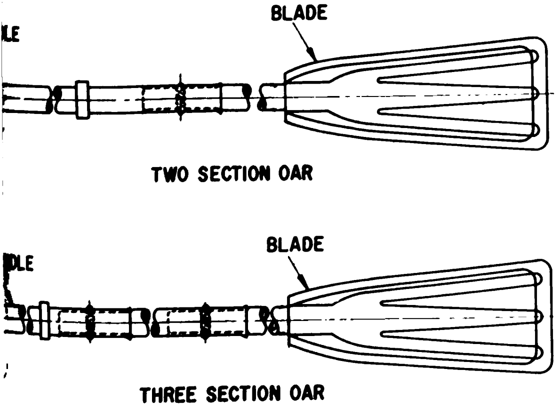
Inflation Pump

umps are provided with all multiplace rafts re used to inflate the rafts in case of failure e CO_2 inflation system. The pump is also to top off the raft after initial inflation CO_2.

land pumps are stowed in the accessories ainer and held secure by a 3-foot length of I nylon line.

stle

whistle (police type) is provided for all and is stowed in the supply pocket. The tle is to be used by personnel for attracting attention of a rescue ship or personnel in foggy weather or at night. In still air and perfect silence, the whistle may be heard for 1,000 yards. Many successful rescues have been due to the use of a whistle. For security of the whistle, it is attached to a 3-foot line.



gure 15-2.—Pneumatic raft sectional oar.

Nylon Cord

For utility purposes, type I nylon line is supplied with each raft. It is supplied in lengths of 100 feet and 200 feet for use as prescribed in applicable directives.

Bailing Sponge

Bailing sponges are provided for all rafts. The bailing sponge is of the common cellulose variety and is provided in varying quantities for the different size rafts. The sponge is used for bailing water collected in the bottom of the raft, and may also be used for collecting rainwater for drinking purposes.

Raft Carrying Case

Rafts are packed in carrying cases constructed of orange-yellow-coated fabric corresponding to the color of the rafts. The carrying case is designed to hold the raft in a deflated but ready condition for inflation whereever it is stowed. The closing hems of the case are fitted with snap fasteners, capable of being released in any direction of pull. The tenacity with which these snaps hold the raft in its case must not be too great. The pressures exerted by an inflating raft must be sufficient to "pop open" the snaps and release the raft without damage.

Retaining Line

The purpose of the retaining line is to secure the raft to one of the users, thus preventing its loss before and after the raft is inflated. It consists of a 10-foot length of 1-inch webbing and is orange-yellow in color. One end is secured to the neck of the CO_2 cylinder while the other end has a snap which can be attached to the lifevest retaining loop of the user. Attached to the snaphook is an instruction tag (3 1/2 x 5 inches) of type O fabric. The tag is imprinted with 1/2-inch letters, and reads: BEFORE INFLATION, CLIP SNAPHOOK TO LIFEVEST.

When the raft is packed in its carrying case, the retainer is accordion folded and held in place inside with breakable nylon thread or synthetic elastic bands. The free end of the retainer, with the snaphook and instructions, is rigged to emerge from the carrying case adjacent to the CO_2 inflation handle for quick attachment to the user.

Liferafts to be placed in wing or fuselage compartments of aircraft for remote control operation must be folded and packed WITHOUT carrying cases in accordance with the aircraft Maintenance Instructions Manual.

Sea Anchor

The sea anchor furnished is a circular cone-shaped fabric device with an open bottom. The sea anchor is packed so that it falls into the water as soon as the raft is inflated. This reduces the danger of capsizing the raft by checking the drift and holding it "bow on" into a heavy sea. By reducing wind drift and slowing the raft down, the sea anchor also makes it easier for a man in the water to catch the raft. The sea anchor is also important in case of a helicopter pickup, for it helps keep the raft from drifting in the downdraft created by the helicopter rotors.

By virtue of the nature of its use, a sea anchor must be securely rigged to a strong mooring purchase. Such a mooring purchase is devised in a patch which, when cemented to the raft, is capable of withstanding a perpendicular pull of 400 pounds. Once the raft is inflated, a strong keeper line, which is longer than the one originally attached, should be secured between the raft and the sea anchor. In making the additional purchase, it should not be secured to the same mooring patch.

Hammock Bed

The raft hammock is suspended between the flotation tubes. The taut canvas provides a means of keeping off the floor when weather and sea conditions are adverse. The hammock may also be used to protect survivors from wind and rain.

The hammock is constructed of water repellent fabric, and is secured to the raft by wooden toggles and loops of webbing. One hammock is furnished with the Mk 4. Larger rafts are furnished with two. Hammocks are stowed in the accessory container.

Mast Clamp

The mast clamp is used primarily as an a in rigging a sail. In lieu of the mast clamp, nyl cord can be used in securing a crossmemb of an oar, serving as a mast. The clamp a line can also be used in securing a distre signal to an oar. The mast clamp is stowed the raft supply pocket.

Emergency Equipment Container

The emergency equipment container suppli for the Mk 4 and Mk 7 rafts is drumlike shape. The container has a slide fastener cl sure installed in one end for admittance of t equipment.

Each container is stenciled in 1-inch lette with the Mk number corresponding to the number of the raft. A strip of type R ta accompanies each container. It is used sealing the slide fastener after the contair has been equipped. For shipment by the mar facturer, the empty container is secured to raft by fastening the snap of the container li to the lifeline of the raft near the CO_2 cylind

Accessory Container

The accessory container is constructed type O fabric. The oars and hand pump among the items included and stowed in accessory container. The container is protec at each end by a wad of felt or cheesecl approximately three-fourths inch thick. T padding protects the equipment from dama when dropping the raft from aircraft. T hammock beds and paulin can be utilized protect the other items stowed in the contain The following words are stenciled in 1/2-i letters on the body of the container:

OARS, PAULIN, PUMP, HAMMOCK BED,
CORNER REFLECTOR, SMOKE SIGNALS
DYE MARKERS, SPONGES.

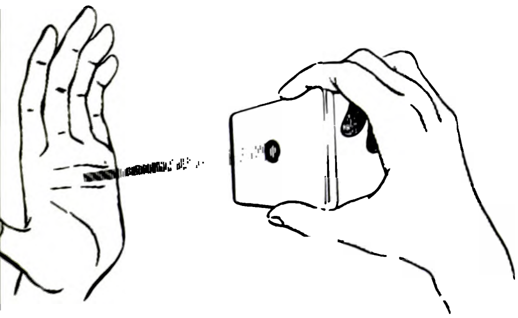
Since multiplace rafts vary in size, container sizes also vary to accommodate m equipment needed for the larger rafts.

Signaling Mirror

The emergency signaling mirror is appro mately 3 x 5 inches and consists of an alur nized reflecting mirror glass, a back co glass, and a sighting device. It is used personnel in rafts or on land to attract att tion of passing aircraft or ships by reflect

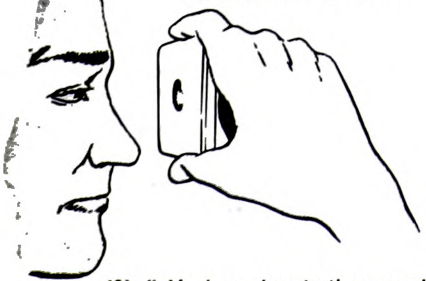
in sunlight or in hazy weather. The
tions of this shatterproof mirror can be
at a distance 3 to 5 times as great as
which a raft can be sighted at sea. On a
sunny day, the mirror will reflect the
lent of 8 million candlepower. Flashes
he mirror have been seen from a distance
niles.

gure 15-3 illustrates the operation of the
ing mirror. Past experience indicates
ersonnel may have difficulty using the
r in a bobbing raft at sea. Practice
ing with the mirror on the ground should
couraged as part of the training program
ght crews. Such practice will reduce the
lty in case of emergencies. Before using
irror, the protective coating must be re-
from its surface.



leflect sunlight from mirror onto
nearby surface.(raft,hand,etc.)

(B) Slowly bring mirror to eye level and look through sighting hole. A bright light spot will be visible. This is the aim indicator.



(C) Hold mirror close to the eye and slowly turn and manipulate it so that the bright light spot is on the target.

Figure 15-3.—Operation of the signaling mirror.

Jackknife

The jackknife is a scout type, consisting of one large blade, a combination screwdriver and bottle opener, and one can opener. It is furnished with a 3-foot lanyard. One jackknife is furnished with each raft and stowed in the supply pocket. The value of a jackknife, especially under emergency circumstances, need not be emphasized as everyone can visualize its usefulness. When in a raft, one should never let the opened knife dangle from its lanyard nor lay on the bottom of the raft.

Pocket Compass

The magnetic card type compass is encased in a cylindrical transparent plastic cover with a reference line inscribed on top of the case. A circular card swings on a jeweled bearing, while a centered pivot supports and suspends the card in its free movement.

To cage the compass and protect the jeweled bearing, it is stored in an inverted position. The compass is reasonably shockproof, but it should be handled with care if one is to expect reliable readings. Damage to the case will impair its waterproof qualities, and promote corrosion in spite of its internal corrosion-resistant construction. Fittings outside of the base adapt the compass for wrist wear. One compass is provided for each raft and is stowed in the supply pocket.

Corner Reflector

The corner reflector shown in figure 15-4 is to be used on rafts to increase the range of radar detection. The reflector has the property of reflecting back to the source a large portion of the radar energy that strikes it.

The corner reflector, also known as a "target" reflector, is an umbrellalike antenna made of eight triangular planes of Monel metal mesh that intersect each other at right angles. The effective range of the reflector is from 2 to 18 miles.

One MX-138A corner reflector is stowed in the accessory container. The sealed carton containing the reflector is not to be opened except for actual emergency use. Each carton is provided with a short lanyard for securing it to the accessory container, which, in turn, is secured to the raft.

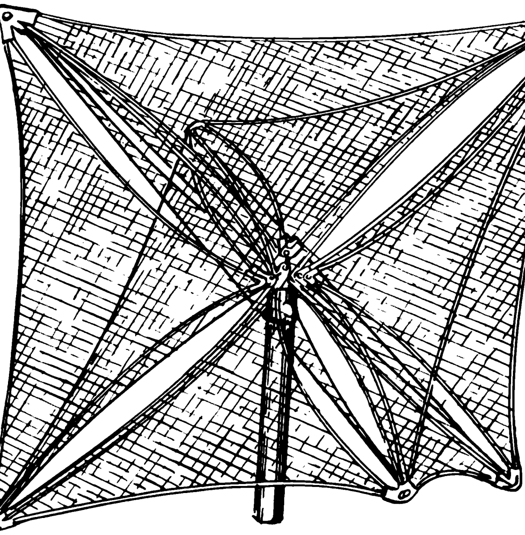


Figure 15-4.—Corner reflector.

Although corner reflectors are manufactured ccording to specifications, certain minor varia- ons (latitude in manufacture) in the details of nstruction, which do not materially affect their erating characteristics, are permitted. Real- ing this, the following steps are given as a neral guide and are not to be considered as ing inflexible rules. They are presented to miliarize the Parachute Rigger with the gen- al erecting procedures for the MX-138A and/ the MX-138A/A corner reflectors.

1. After removing from carton, tie end of ecuring line to raft and remove taped paper ollars from each end of reflector.
2. Unwind the steel stay cable having an fastened hook at its end.
3. Unwrap wire mesh carefully from around etal arms. Shake reflector gently and pull out- ard slightly on each arm to free mesh planes.
4. With hub toward you, grasp the two arms, ving red painted ends, near the hub and pull wn until they are at right angles to the hub; at e same time, pull on the arm, to which the ay cable will be attached (instruction tag is ed to this arm), until it is also at right angles the hub.
5. Holding the three arms at right angles ear as possible to right angles), brace end of m to which tie cable is attached against toe shoe and flip reflector open.

NOTE: Since the planes must be stretched gidly in order to function properly, one or two of the aluminum arms might tend to bow the tension as the reflector is brought to open position. The bowed condition of th will not affect the function of the planes ever, a kink in any one of the tube ar weaken the tension on the planes and sagging condition.

6. Insert hook on stay cable in ey opposite arm to hold reflector open and tension.
7. Connect two sections of oar handle t mast and slip end through loop in stay Mount reflector on mast, making cert it is secured firmly.
8. Force rubber oar collar over fre mast, working it along a short distance. of mast through mast holder on raft.

With end of mast through the raft force on a second rubber collar. Slide it out of the way. Slip end of mast in cup bottom. Now, adjust the two rubber colla on top of the holder and the other on the b so that the mast is forced down again bottom of the raft.

9. The mast places the reflector at a p height for air search, but when a surface is sighted, add all extra sections of oar h to mast and hold reflector as high as pos DO NOT WAVE REFLECTOR.

CAUTION: The effectiveness of a c reflector depends on the accuracy of its angled corner. Do not tear, warp, or disto planes.

Water Storage Bags

The water storage bags are made of s transparent pliable plastic and will hold 5 q of water. The open end is reinforced a designed to hold itself in a closed positio seal the bag, use must be made of the and buckle located near its end. The bag be sealed tightly by rolling or folding its op for a short distance, and by securing the with the strap and buckle.

When the bag is not being used for ho water, it can be used for stowage of ite need of protection from salt water. Prote articles in this manner can lead to contamina therefore, articles should be wrapped in so thing to prevent lubricants and other cont nants from coming in direct contact with interior of the bag. Water storage bags can be inflated, coupled with one another, and as water wings for swimming. Water sto are stowed in the equipment containers ts.

arkers

e dye marker packet contains a small ty of crystalline dye compound. When the ound is exposed to the water, it slowly ves while producing a brilliant yellowish- fluorescence. Under good conditions the exhausted in 20 to 30 minutes and ceases a good target after an hour. The dye is e at an approximate distance of 10 miles 00 feet altitude.

exterior orange-yellow envelope serves urposes of: (1) providing a waterproof ner for the dye compound in a loosely bag; (2) acting as an anchoring point for e pouch which is secured to a long tape;) supporting a tape across the top of the pe which is used to tie the marker to vests ther basic items of survival. The acces- s container of each raft is supplied with 12 dye markers, depending upon the size raft. (See table 15-2.)

gency Signaling Code

e Ground Air Emergency Code was de- d to establish an international means of unication by the use of symbols between vors and search and rescue parties. Its ctions and illustrations, printed on tough -resistant paper, outline a series of con- s relative to emergencies in connection disabled aircraft, medical problems, land- structions for the rescue party, etc. Strips th, sticks, stones, or anything available may ed to create the symbols.

e importance of the code is illustrated by mber of survival items which are equipped it. One copy of the code is inserted in the ction data pockets of all parachutes. The type parachute loses its pack upon opening; fore, the parachute is specially equipped a code pocket located on the yoke of its eb assembly. A copy of the code must also ade available for navigation chart boards n places where chart boards are not used. ode may also be posted in the flight com- ent of aircraft.

ting Kit

e desalting kit is used for making potable from salt water. Each package of chemi- riquets), when mixed with sea water in the plastic bag, makes about 1 pint of drinkable water. Before the chemical kits were made available, fresh water was contained in pint-sized cans. The cans of water posed many problems. They were cumbersome, weighty, became undrinkable with age, and invited rust. Although the kits represent a great advancement, their potential is limited to the number of briquets that are packed in them. Therefore, it is of utmost importance to start the solar still as soon as possible after being downed at sea.

The desalting kit consists of a hinged metal container with a retaining lanyard, seven or eight wrapped desalting briquets, a length of mending tape, and a plastic bag for processing the water to be desalted. The briquets, processing bag, and mending tape are attached to a nylon tie tape, to each other, and to the metal container. The desalting kits are stowed in the emergency equipment container.

The vinylite bag should be rinsed to decrease the taste which passes into the treated water. This is done by filling the bag one-third full of sea water and rubbing the inner surfaces of the bag gently for 2 minutes, then rinsing several times with fresh sea water.

The chemical process is purposely adjusted to leave a little salt in the desalted water to compensate for perspiration losses. If a less salty taste is desired, a smaller amount of water can be used in the bag.

The procedure for using the desalting kit follows:

1. Close valve at the bottom and fill bag to line with sea water.
2. Take out one package of chemical and close container.
3. Remove outer wrapping of briquet, tear off one end of transparent inner wrapping, and pour all of the chemical into the bag of sea water.
4. Fold the top of the bag down tightly, rolling it towards the buckle and strap to make a watertight seal.
5. Permit the chemical to stand in the bag for a few minutes, and it will disintegrate.
6. Further pulverize the chemical by kneading it gently for 15 minutes.
7. Shake the bag gently for 30 minutes.
8. To drink the water, unscrew the valve located at the bottom of the bag, being careful not to squeeze the bag. Put the tube in the mouth, and gently squeeze the bag or suck on the tube. Spit out the first few drops if too salty.

9. When finished drinking, close valve. The emaining water can be left stowed in the bag.

10. When all the water has been drawn from he bag, rinse out the chemical with sea water. 'he bag is then ready for reuse.

11. In case the bag becomes damaged, dry he affected area carefully and apply a patch of he mending tape provided.

If the plastic bag becomes damaged beyond epair, or is lost, the metal container can be sed. In this case, fill the container to the line narked on the inside. Then add one package of he chemical and shake the can gently for 30 ninutes. Drink the water through an emergency ilter, made by holding a piece of cloth over the op of the can.

olar Still

The solar still is used for the purpose of onverting salt water to potable water. It is a eliable means by which man is assured an adeuate supply of fresh water for long periods at ea. The still operates most effectively in direct unlight, and will produce approximately 2 pints f water per day. It will also work on cloudy lays if the weather is hot. The water obtained s fresh and pure, and although it may have a narmless plasticlike taste, especially when the still is first used, one can survive on it.

The first distilled water may be milky beause of the talc which is sprinkled on the nside of the bag at the time of manufacture o keep the plastic from sticking together. In setting up a new still, throw away the first 2-hour output, because the chemical preservaive used inside the new bag will be in the water. To drink the initial output might make one sick.

The solar still is a spherical-shaped enveope fabricated of vinyl plastic film and packaged n a vinyl plastic film container. On one side of he still is an attached towline with hook. The nflating tube and fresh water drain are attached at the bottom of the still. Stills are provided one per rated man-capacity of the raft.

The procedure for operating the solar still follows:

1. Wet the cloth drain on the bottom of the still. This prevents air from escaping through the cloth until the still is fully inflated. The cloth then acts as a safety valve so that the still cannot be overinflated. Excess air escapes through the cloth.

2. Inflate orally through the inflating tube until the still is round and firm as shown in figure 15-5. The suspension points sho dent, indicating that it is properly in Kinks in the inflation tube will prevent infl

3. Place the still in the water, and holding it upright, fill the reservoir wi water. When the ballast tube is full, th will float in an upright position withou held. The reservoir should always be ke Refill when water drops to the lower m the cup. This should be necessary abou every 1 1/2 hours.

The salt is distilled from the wat follows:

The sun's rays heat the sea water black evaporator cloth stretched acros center of each still, causing evaporation vapor then condenses on the sides of the cover in the form of beads which run d the fresh water trap below the ballast The salts, however, do not evaporate, bu main temporarily in the black cloth until wa out the drain at the bottom of the still. The is self-cleaning and need never be was

When operating, the still has a silvery pearance which is caused by condensati fresh water on the inside of the bag. upper half of the bag loses its silvery ap ance in spots, pull on the string located cup to clear the water feed of foreign m

The still has to be topped off wit periodically. The bag should be sufficient flated at all times to prevent the cloth

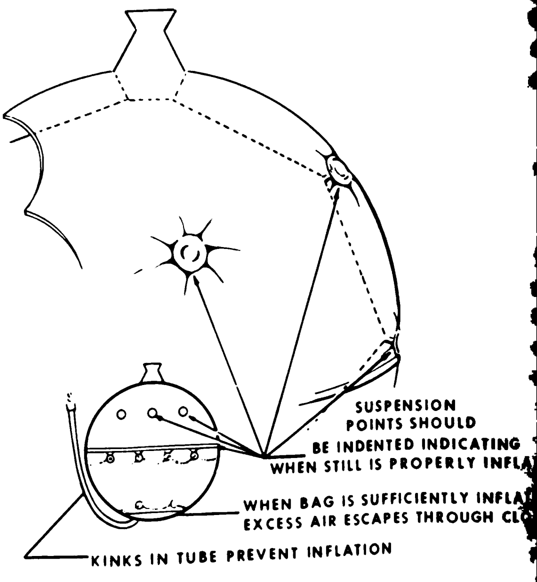

SUSPENSION
POINTS SHOULD
BE INDENTED INDICATING
WHEN STILL IS PROPERLY INFLA
WHEN BAG IS SUFFICIENTLY INFLA
EXCESS AIR ESCAPES THROUGH CL
KINKS IN TUBE PREVENT INFLATION

Figure 15-5.—Inflated still, showing suspension points.

ing the outer bag, because the bag will become contaminated with salt from the L.

e bag may be deflated at night. If it is, turn side down until the water runs out and the st tube is empty. Rubbing the cloth at the m with a dry cloth makes the still easier flate when pressure is applied to collapse hen the still is put in use the next day, it ld be drained of fresh water after the first inutes to remove any salt water which may accumulated inside the still after it was ted.

hile the solar still is surprisingly strong in respects it can be cut easily. Therefore, should be taken to avoid having it come in act with sharp objects. If the still is cut, it ld be repaired immediately with the mending . This tape is applied in the same manner dhesive tape.

Paulin

he paulin furnished with rafts is used for her protection, water collection, camou- e, as a signal, or as a sail attached to an

he paulin is a rubber-coated (neoprene), n-base cloth. When laid out flat it is rectan- r in shape. A reinforced hem around the meter of the paulin supports a series of nmets. The grommets are provided for ty purposes, making it possible to lace the in into many shapes for use as cover, sail, catcher, or anything else devised for the sion.

he weatherproof tarpaulin is colored neon (older paulins are orange-yellow) on one and nonspecular blue on the other. The 4 paulin is 72 x 108 inches.

he paulin may be rigged as a sail to speed movement or to navigate the raft in a de- d direction. Care should be taken in strong ds to prevent capsizing. The paulin can be tched across the raft to give protection n heat and cold. Rain for drinking purposes ollected in a pocket located in the center of paulin. In signaling with the paulin, refer to system illustrated in figure 15-6. To insure plete familiarity with these signals it is gested that periodic drills be conducted in the al use of the paulin for signaling. Standard raft acknowledgments are shown in figure 6.

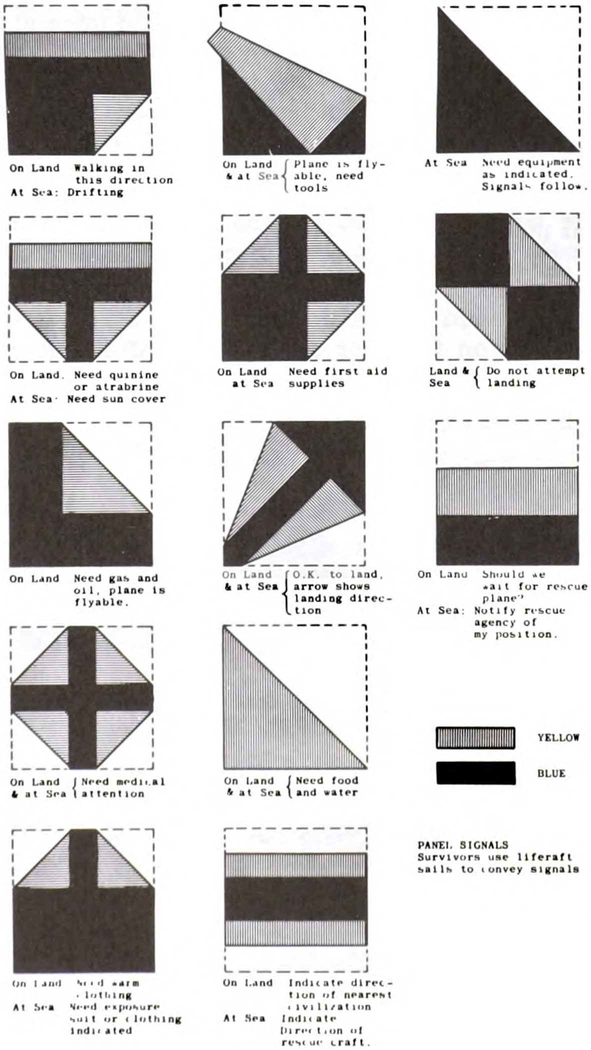

On Land Walking in this direction
At Sea: Drifting
On Land & at Sea { Plane is flyable, need tools
At Sea Need equipment as indicated. Signals follow.
On Land. Need quinine or atrabrine
At Sea: Need sun cover
On Land at Sea Need first aid supplies
Land & Sea { Do not attempt landing
On Land Need gas and oil, plane is flyable.
On Land & at Sea { O.K. to land, arrow shows landing direction
On Land Should we wait for rescue plane?
At Sea: Notify rescue agency of my position.
On Land & at Sea { Need medical attention
On Land & at Sea { Need food and water
YELLOW
BLUE
On Land Need warm clothing
At Sea Need exposure suit or clothing indicated
On Land Indicate direction of nearest civilization
At Sea Indicate Direction of rescue craft.
PANEL SIGNALS
Survivors use liferaft sails to convey signals

Figure 15-6.—Paulin signals and standard aircraft acknowledgements.

Distress Signals

The Mk 13 Mod 0 distress signal is used for day or night distress signaling. The signal may also be used to give wind drift information to helicopters performing pickups of downed personnel.

The Mk 13 Mod 0 distress signal is a pyrotechnic torch that burns approximately 18 seconds. It produces a red glow for night use and orange smoke for day use. Before igniting, select the signal (day or night) to be used.

The night flare can be identified in the dark by a series of small beadlike projections that are embossed around its circumference. After selecting the flare to be used, the sealing tape should then be torn off from around the end of the cylinder and the paper cap removed. (See fig. 15-7.) The pull ring is brought down over the rim of the can and pressed down, using the ring as a lever to break the seal. The ring is then quickly pulled up and as it comes out of the can it ignites the smoke mixture. Smoke will pour out immediately.

The signal should be held at arm's length and at about a 30-degree angle from the raft. Care should be taken not to drop any of the contents on the user or the raft. After one end of the signal has been expended, it may cooled by immersing in water and then sa until both ends have been used. Signals sho always be doused in water to cool before be stored.

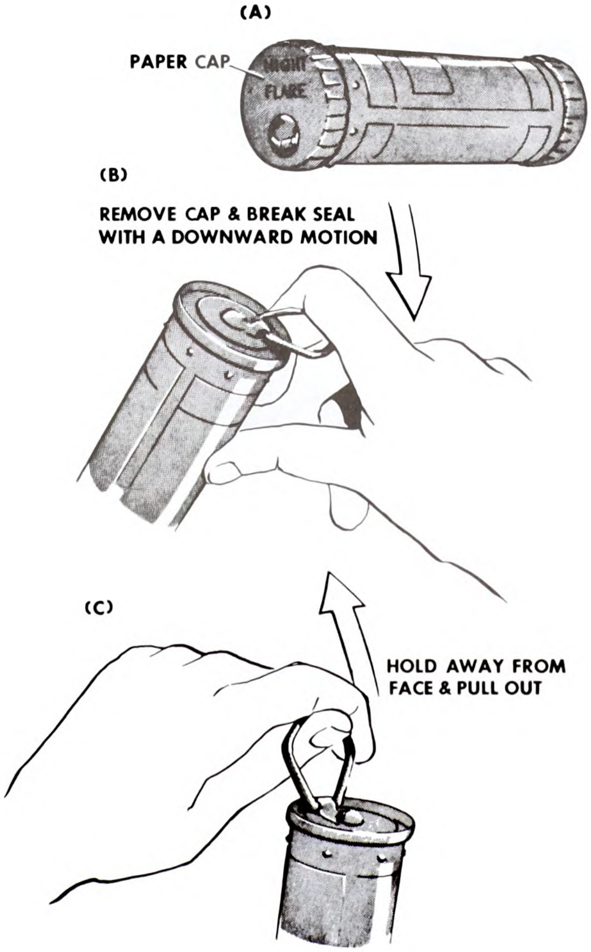


Figure 15-7.—Igniting the Mk 13 Mod 0 distress signal.

First Aid Kits

One first aid kit is used with each of multiplace rafts and is stowed in the emerge equipment container. The kit is installed wh the raft is put in commission. The directi for the emergency use of the medicine and equ ment can be found inside each first aid

The first aid kit is a Bureau of Medic and Surgery item.

Sunburn Ointment

Sunburn ointment is provided in a sm container and should be stowed in the em gency equipment container to prevent it fr deteriorating.

The sunburn ointment should be applied to parts of the body that are exposed to the sun. most effective results, rub the ointment w into the skin. The ointment can be used in t same way to give protection from windbur cold areas.

Rations

Tablet rations are contained in a pneuma cally sealed can which can be opened with the provided. Each unit contains the following:

5 sucrose citric acid tablets
10 sucrose lipid citric acid tablets
2 multivitamin tablets
2 sugar-coated chewing gum tablets
1 waterproof bag and 2 clips for the purp
of preserving unused portions of the ratio

One can of rations should be supplied for ea man for which the raft is designed to accomm date. The rations are stowed in the emerge equipment container.

PACKING THE MK 4

Rafts must be properly folded, rolled, a packed; then stowed in the location prescrib in the aircraft flight manual. This will rend them ready for immediate use in the event an emergency over water.

The following procedure for packing appli to the Mk 4 and multiplace rafts in gener

Store all accessory and emergency equip- in the containers provided. Seal the sup- ockets and the emergency equipment con- r by closing the slide fastener and sealing a strip of tape, type R, 1 5/8 inch

Attach a fully charged CO_2 cylinder of roper size and type (as prescribed in al Aeronautic Requirements-375) to the lon manifold and store in the cylinder er. Connect raft retaining line to the neck cylinder.

OTE: Inspect the safety wiring of the pull e for compliance with BuWeps Aviation ing and Survival Equipment Bulletin 7-61. must be done before the raft is packed. If ire is broken, reweigh the CO_2 bottle and y-tie.

Completely deflate the raft, using a suit- vacuum pump (the common household type m cleaner is adequate). Open the topping- alves and apply suction. As each flotation ber is deflated, close the valve while still ing suction.

ARNING: A raft which is not completely ted is difficult, if not impossible to pack erly, and in addition, poses a serious lem to the efficiency of the aircraft involved, to expansion of the trapped air at high des.

To prevent the folds of rubberized fabric sticking together, the entire raft must be d with talc. Give particular attention to the under the flotation tubes at the junction of lotation tube and the raft bottom. This talc as a mild abrasive and assures a smoother nore positive unfolding action when the raft ing inflated.

Check the raft righting handles and the sea or retaining line for entanglement.

Inspect the emergency and accessory ment containers for contents as listed in s 15-1 and 15-2. Replace any item which is ing or damaged. Check for security of re- ng lines.

The words "Lash all equipment to raft to ent loss" should be stenciled inboard of the centerline on the flotation tube using black, ch letters. Other paint and markings on rafts h are illegible or otherwise unreadable ld be restored.

Lay out the raft case and inspect it for s of wear, abrasion, rips, tears, or de- ration from acid or other damaging agents. ck the snap fasteners for operation and general condition (replace as necessary). Talc inside of case.

9. Position the accessories container in the center of the raft with the top end of the container in line with the valve of the CO_2 cylinder. (See fig. 15-8.)

10. Figure 15-9 illustrates the proper method of folding and rolling the Mk 4. Keep the raft retaining line and the emergency equipment container retaining line clear and positioned so that the emergency equipment container line emerges from the packed raft on the end opposite the CO_2 valve and the raft retaining line,

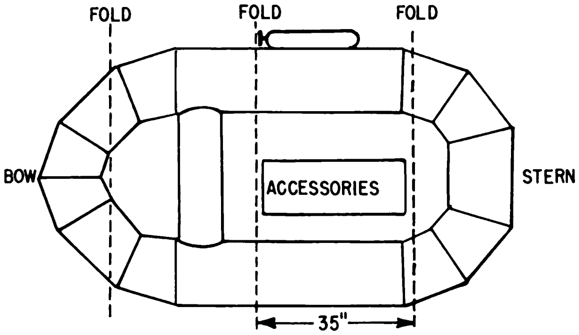


Figure 15-8.—Position of the accessory container.

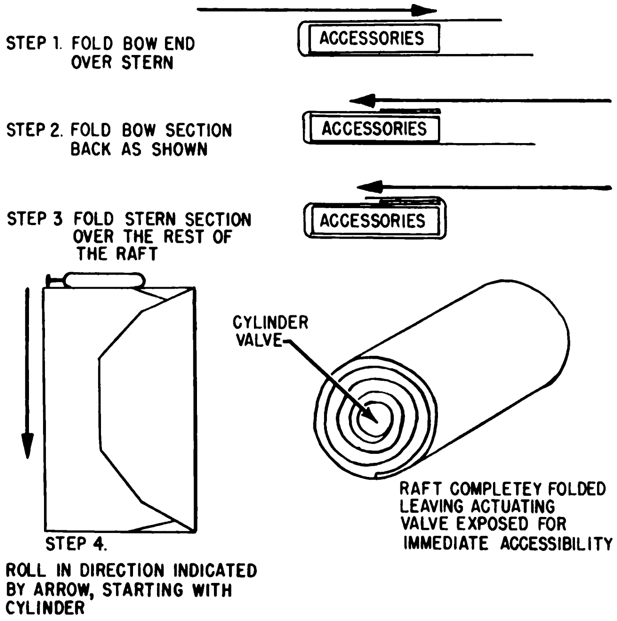

STEP 1. FOLD BOW END OVER STERN
ACCESSORIES
STEP 2. FOLD BOW SECTION BACK AS SHOWN
ACCESSORIES
STEP 3 FOLD STERN SECTION OVER THE REST OF THE RAFT
ACCESSORIES
CYLINDER VALVE
RAFT COMPLETEY FOLDED LEAVING ACTUATING VALVE EXPOSED FOR IMMEDIATE ACCESSIBILITY
STEP 4.
ROLL IN DIRECTION INDICATED BY ARROW, STARTING WITH CYLINDER

Figure 15-9.—Folding and rolling the Mk 4.

attached to the CO_2 valve, emerges from the same end of the case.

11. After making the top fold and before starting to roll the raft, coil or fake the sea anchor retaining line on the top fold and place the sea anchor over this line.

12. Roll the raft, starting from the side with the CO_2 bottle attached. Leave the valve of the CO_2 bottle forward of the folds of the raft to permit it to emerge from the center of the end of the carrying case after the raft has been completely packed.

13. An inspection and packing data card should be signed by the person responsible for the work accomplished. This tag should be attached to the neck of the CO_2 bottle, so as to be visible at all times without unpacking the raft.

AR-4 DROPPABLE BOAT

The AR-4 lifeboat is designed to be dropped from the bomb bays or bomb racks of aircraft at altitudes of 100 to 150 feet and at an indicated airspeed of 100 knots. The assembly is designed to accommodate four survivors.

In the packed condition the assembly is 41 inches in length and 16 inches in diameter. Total weight is 110 pounds. It may be carried within the fuselage or cabin of large aircraft and dropped by hand from hatches. Two adjustable supporting straps are supplied with the container so that the unit may be slung torpedo fashion between the bomb racks. These straps are attached to the container in such a manner that in the event that only one bomb rack is released, the strap will pull free from the container and not impede the fall of the assembly.

The AR-4 shown in figure 15-10 is a four-man pneumatic lifeboat of double tube construction. The boat is complete with a sailing rig, mast, rudder, keel, weather shield, sun canopy, sea anchor, and an inflatable floor. After inflation, the boat is 9 feet 3 inches long and 5 feet 3 inches in beam.

INSPECTIONS

As on all pneumatic survival equipment, the AR-4 must be thoroughly inspected prior to packing. The following inspections, as applicable, must be conducted on the AR-4 assembly:

Prior to being placed in service.

Every 3 months thereafter.

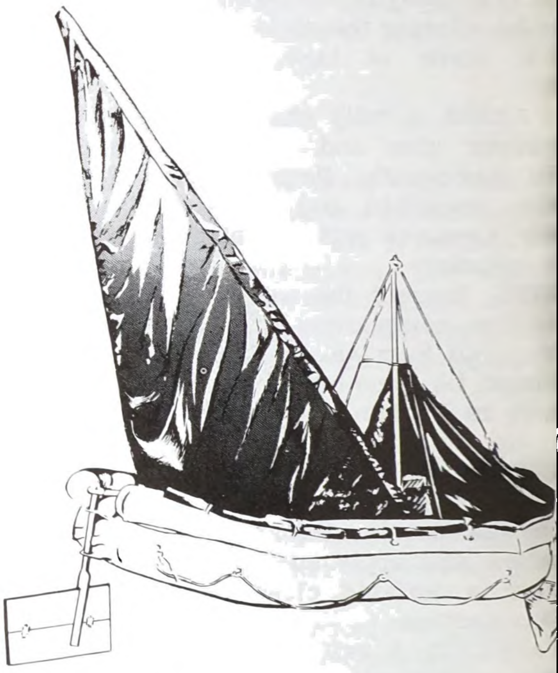


Figure 15-10.—AR-4 droppable boat.

1. Inflate the boat with the installed infla
system to ascertain that all parts of the eq
ment perform properly.

2. Inspect all the metal parts for evide
of corrosion, and examine the body of the b
weather shield, spray tube, and inflatable f
for deterioration.

3. Remove the CO_2 cylinder from the
and check the manifold for leakage with a so
water solution.

4. Deflate the boat using a suitable defla
or suction pump to insure complete rem
of all CO_2 gas.

5. Inflate one compartment of the boat
air to 2.0 psi pressure. Remove the cap f
the topping-off valve on the deflated compa
ment. After 1 hour, again check the press
and adjust, if necessary, to the original press
of 2.0 psi. Record barometric pressure
temperature, and allow the compartment to
main inflated for 24 hours.

6. Conduct the same test on the other co
partment of the boat.

7. Make correction of any temperat
changes. If the pressure of either compartm
drops to less than 1.25 psi, consider the b
unfit for issue and check it further for lea

racticable, the leaks should be repaired. airs are discussed later in the chapter.)

. Test spray tube and each compartment of inflatable floor as above with the exception the initial pressure should be 1.0 psi with op to 0.5 psi permitted after 24 hours.

. Deflate the boat. Use a deflation or suc- pump to insure complete removal of air.

. Attach a correctly charged cylinder ck weight) to the manifold and tighten all ections.

. Check all sailing, signaling, and survival pment for completeness, proper stowage tion, and where practicable, operation.

. Examine the raft case for oil and acid ns, and for any visible defects or deteriora- likely to damage the contents of the case.

KING INSTRUCTIONS

he AR-4 boat must be deflated completely re the packing procedure is started. Spread boat flat so that the gear may be stowed it. Fold each side toward the middle and on of all the stowed gear. The CO_2 actuator trol cable must fall on top of the starboard in a manner so that it can be operated r the boat is rolled.

Roll the boat from each end toward the CO_2 nder at the center. When rolling from the to the cylinder, care must be taken in er that the keel cable will not foul during inflation of the boat. The cable is held as r as possible to the center of the bottom ing the rolling operation. The keel must extended flat on one side. The CO_2 actuating trol must be kept clear.

The boat is placed in the carrying case, led and rolled, with the open portion up, and ned with the carrying case opening. This is assure that the boat will float and inflate ht side up on the water. After this, the case closed as the releasing assembly is engaged.

MK 7 RAFT

The Mk 7 raft is basically the same in design the Mk 4, except in size and amount of equip- nt carried. It is 12 feet long and 5 feet 8 hes wide when inflated. Its gross weight en packed (including the CO_2 system with all ipment) is 114 pounds. The internal volume the CO_2 cylinder is 205 cubic inches, and the 2 charge required to inflate the raft to 1 psi is 4.70 pounds. The raft provides a maximum buoyancy of 2,500 pounds.

EQUIPMENT

The Mk 7 is designed to accommodate seven survivors and carries accessory and emergency equipment to sustain this number for 7 days. This equipment is listed in tables 15-1 and 15-2.

PACKING

Attach a fully charged CO_2 cylinder to the inflation manifold. NOTE: Check pull cable for compliance with BuWeps Aviation Clothing and Survival Equipment Bulletin 7-61. Stow equipment, dust entire raft with talc, and position raft case in the same manner as with the Mk 4.

At a point as near the filler manifold as possible, fold the bow section over the stern. At approximately 35 inches from this fold, fold the bow section back over itself. The stern section is then folded over the raft and back again to make the folded width of the raft about 35 inches.

Beginning on the side with the CO_2 bottle, roll as tightly as possible. (See fig. 15-11.) Complete the packing in the same manner as for the Mk 4.

MK 12A-1 RAFT

The Mk 12A-1 inflatable raft is intended for use as emergency survival equipment for survivors of transport type aircraft forced down at sea. It consists of two buoyancy chambers (main and upper flotation tube) mounted one upon the other, with a raft body.

The raft is equipped with an inflatable seat, two removable inflatable floors, and a canopy. The canopy is used for protection from the elements. The inner surface of the canopy is blue, for use when camouflage is desired, and the outer surface is fluorescent red to attract rescue craft. It is attached around the outer perimeter of the upper flotation tube and supported over the raft by aluminum bows (ribs).

Initially, the main flotation tube is inflated with CO_2 and a hand pump is provided to inflate the seat, floors, and upper flotation tube through topping-off valves. As an extra precaution against loss of the raft due to an inadvertent rupture of the flotation tubes, internal

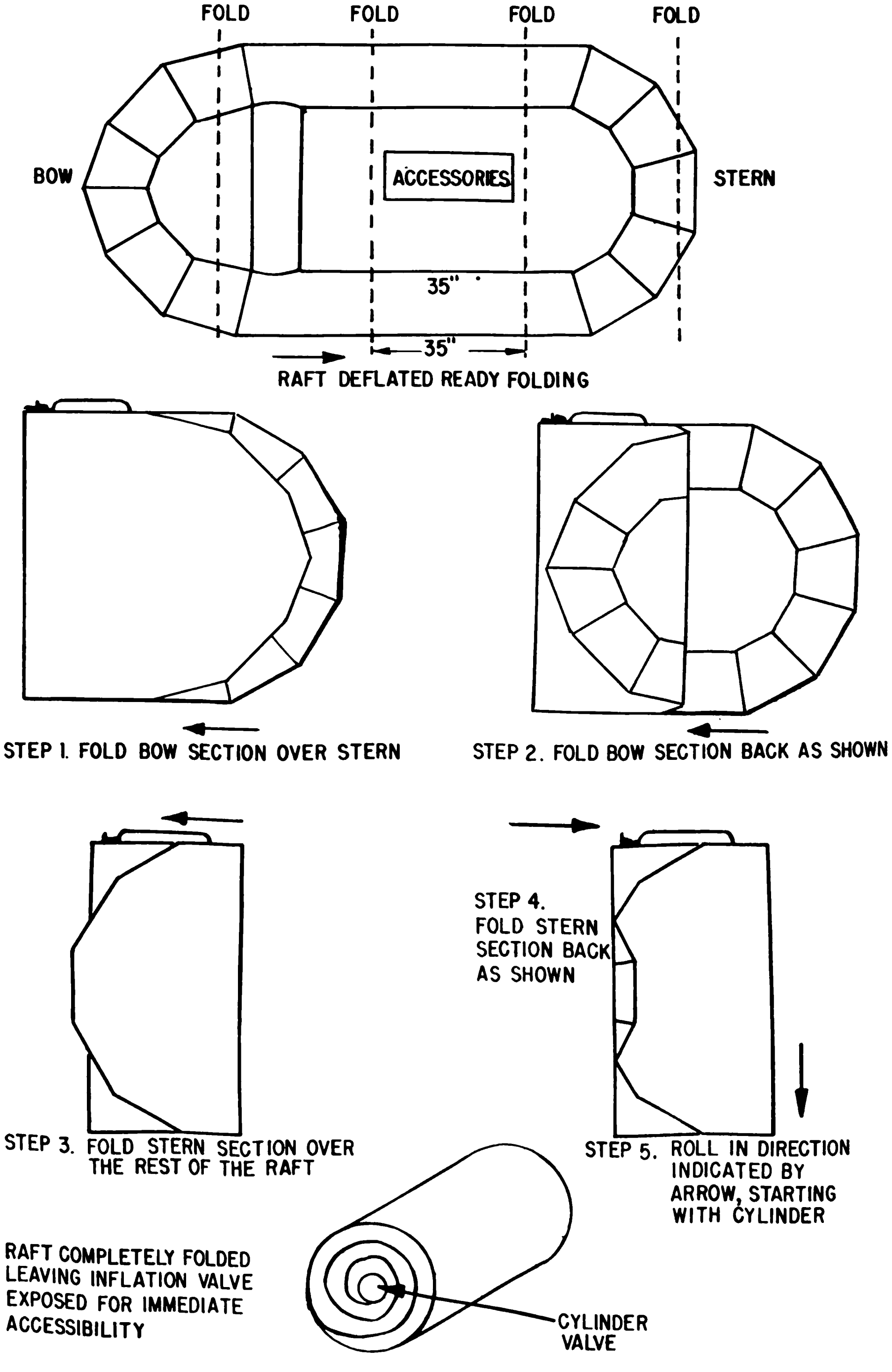

FOLD
FOLD
FOLD
FOLD
BOW
ACCESSORIES
STERN
35"
35"
RAFT DEFLATED READY FOLDING
STEP 1. FOLD BOW SECTION OVER STERN
STEP 2. FOLD BOW SECTION BACK AS SHOWN
STEP 3. FOLD STERN SECTION OVER THE REST OF THE RAFT
STEP 4. FOLD STERN SECTION BACK AS SHOWN
STEP 5. ROLL IN DIRECTION INDICATED BY ARROW, STARTING WITH CYLINDER
RAFT COMPLETELY FOLDED LEAVING INFLATION VALVE EXPOSED FOR IMMEDIATE ACCESSIBILITY
CYLINDER VALVE

Figure 15-11.—Folding and rolling the Mk 7 raft.

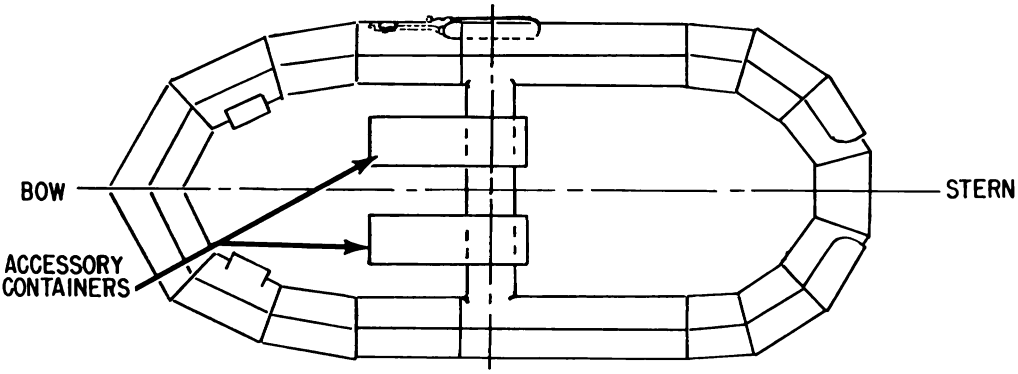
heads divide the main flotation tube verti-
amidships, forming two separate compartts of equal volume.

IPMENT

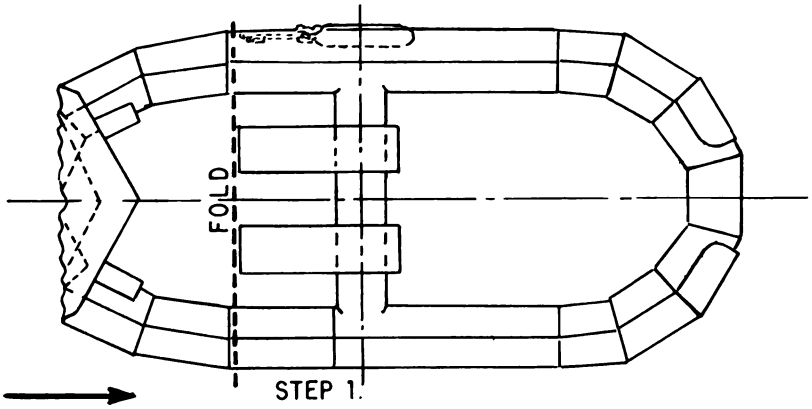
urvival equipment sufficient to keep 12
alive for 7 days is carried in the Mk 12A-1 raft. This equipment is listed in tables 15-1 and 15-2.

PACKING

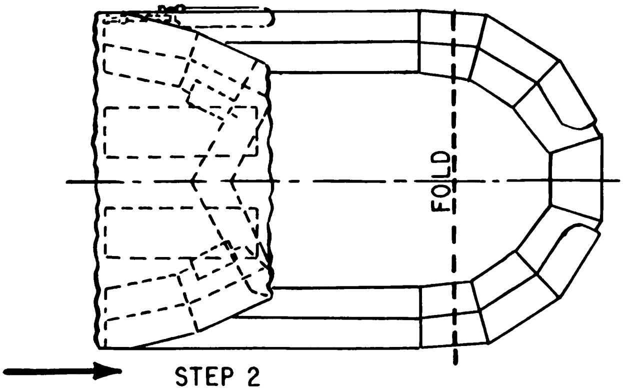
The raft is completely deflated as described for other multiplace rafts, and folded and packed as shown in figures 15-12 and 15-13. The raft



RAFT DEFLATED-READY FOR FOLDING

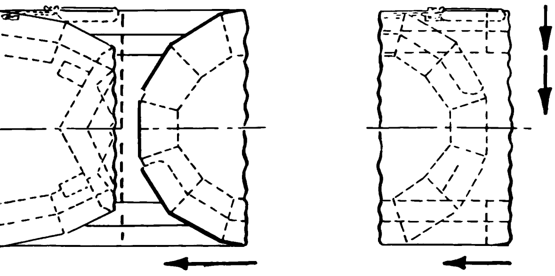


STEP 1.
FOLD BOW END IN DIRECTION INDICATED BY ARROW



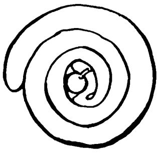
STEP 2

Figure 15-12.—Folding the Mk 12A-1 raft.



OLD STERN END N DIRECTION INDICATED BY ARROW

FOLD CENTER IN DIRECTION INDICATED BY ARROW ROLL STARTING WITH CLINDER END AS INDICATED BY DOUBLE ARROW



RAFT IS NOW COMPLETELY FOLDED LEAVING EXPOSED THE ACTUATING CABLE OF THE CYLINDER FOR IMMEDIATE ACCESSIBILITY

Figure 15-13.—Folding and rolling the Mk 12A-1 raft.

then placed in the carrying case with the axis the CO_2 cylinder running in the same direction the length of the case. The end of the cylinder ntaining the ripcord static line is properly tached to the cylinder inflation valve, the rip- ord pins are inserted through the release nes, and the flaps are snapped.

PERATION

To inflate a raft packed in a carrying case, t the flap on the end of the case, and pull the pcord handle out until free. The handle is tached to the carrying case and actuates the flation valve.

Automatic inflation of rafts installed in air- aft compartments is accomplished by means a control cable attached to the compartment tching mechanism and to the spring type snap the end of the CO_2 cylinder valve release ble. The control cable is attached to a release ndle inside the aircraft. A sharp pull on this ndle first releases the latch of the raft mpartment door, then actuates the inflation stem. Rafts so installed are not packed in rrying cases.

MK 20 RAFT

The Mk 20 inflatable raft is made by mount- g two buoyancy chambers of rubberized fabric (one upon the other) and suspending a between the two chambers. The chambe divided into a main flotation compartme a boarding station compartment by two in vertical bulkheads.

The raft is designed to be right-sid from either side. This is accomplished by tioning the topping-off valves so that the accessible from either side and by placi boarding stations (one on either side) di opposite each other. Incorporated in the fl an inflatable floor support which will main horizontal position for a fully loaded

The flotation compartment and boa ramps are inflated by CO_2 and the infla floor support is inflated with the hand pump equalizer tube is provided between the two flotation compartments to distribute the equally. NOTE: The equalizer tube must be when the raft is packed for use.

OPERATION

To inflate the raft when packed in the car ing case, lift flap on the end of the case pull the ripcord handle out until free. handle is attached to the static line which o the carrying case and actuates the infla valve.

WARNING: Hold the retaining line fas prevent loss of the raft and equipment du actual inflation.

A full charge from the cylinder inflates raft to approximately 1.25 psi. The ini pressure of the gas in the raft may be low, will increase until ambient (surrounding) te perature is reached, then the pressure in the will be 1.5-2.20 psi. This process usually ta about 5 to 10 minutes. If the raft is und inflated after a 10-minute wait, attach hand pump to the appropriate topping-off va and inflate to the desired pressure. Inflate boarding stations with the hand pump immediat ly after all personnel are aboard the raft.

Automatic inflation of the Mk 20 is identi to the Mk 12A-1, described earlier.

PACKING

Prior to packing, inspect CO_2 cylinder safety wiring of the inflation gear assem in accordance with instructions contained BuWeps Aviation Clothing and Survival Equ ment Bulletin 7-61. Inspect the floor for ste ciled instructions for erecting the canopy a er reflector. These instructions must be ly stenciled in 1/2-inch letters.

Vhen packing the raft in the carrying case ust be completely deflated, the cylinder hed, and folded as follows:

. Fold boarding ramps over boarding sta- .

. Check containers for contents as listed Weps Aviation Clothing and Survival Equip- Bulletins and tables 15-1 and 15-2. Fold ylinder end of folded raft over the accessory ainers and position cylinder next to con- rs.

. Position the accessory equipment con- rs approximately 30 inches from and par- to the cylinder assembly.

. Attach accessory containers to the lifeline a 10-foot length of nylon cord, MIL-C- B, type I.

. Maintain maximum width of 35 inches folding.

. Roll remainder of raft around accessory ainers and cylinder.

. The folded raft is placed in its carrying with the inflation valve at the end of the supporting the ripcord handle, and with axis of the cylinder parallel to the length e case. The static line is attached to the tion valve pull cable with the locking pins rted through the release cones. Finally, the flaps, securing the case.

This folding and packing procedure is illus- ed in figure 15-14.

lling for Ejection

n lieu of packing the Mk 20 in a carrying for manual toss-out and inflation, the raft be packed and installed in a compartment ejection. The following steps apply to folding installing the Mk 20 raft for ejection:

. Place the raft on a flat surface after it been completely deflated. Because of the of the raft, a large well-cleaned area of is the best place for packing. The position he inflating cylinder will determine whether raft is stowed in a left- or right-wing com- ment. If the cylinder is facing the wrong ction, turn the raft completely over.

. Fold the raft in thirds so that the cylinder ains at the end of the raft. (See fig. 15-14.)

. Fold back one-half of the top fold.

. Make five folds in accordion pleats so the cylinder is resting on top of the rec- ular bundle.

5. Set the raft into the proper compartment. (See fig. 15-15.) The operating head of the raft cylinder must face inboard with the cylinder at the aft side of the compartment. Place the cylinder on the supporting rack. The accessory container may be placed in the bottom of the compartment before the raft is stowed, or on top of the folded raft.

6. Connect the release cables at the quick-disconnect fittings.

7. Connect the raft lanyard to the raft lifeline, and place the bag holding the lanyard on top of the raft.

8. Close and latch the compartment door or cover.

9. Turn the adjusting screws on the cylinder support rack so that the cylinder is held tightly against the compartment cover.

MAINTENANCE OF RAFTS

All personnel engaged in the handling, inspection, or maintenance of rafts must exercise caution to avoid stepping on or placing any unnecessary objects or items on top of them. Persons engaged in maintenance or repair of unpacked rafts must not step on any part of the raft while wearing shoes, nor on any part of the flotation tubes at any time. Rafts must not be thrown around or dropped since this may cause damage to the raft or its accessories. Particular care must be exercised to prevent hydrocarbons such as gasoline, oil, or grease from coming in contact with any part of the raft or its equipment.

Repairs

Personnel engaged in the repair of rafts and other rubberized flotation equipment must be thoroughly familiar with ACSEB 17-61 and know the various types and uses of cements as well as the correct procedures to be followed when making necessary repairs to this equipment.

TYPES AND USES OF CEMENT.—The rubber compound used in the manufacture of rubber cement must be the best quality Para rubber obtainable. Compounding materials must be added in sufficient amounts to insure that the resulting cement will have the desired qualities.

The cement should contain a solvent which will evaporate leaving a flexible film having suitable tackiness, strength, adhesion, aging, and working qualities for the purpose intended. The solvent must be benzol, solvent naphtha,

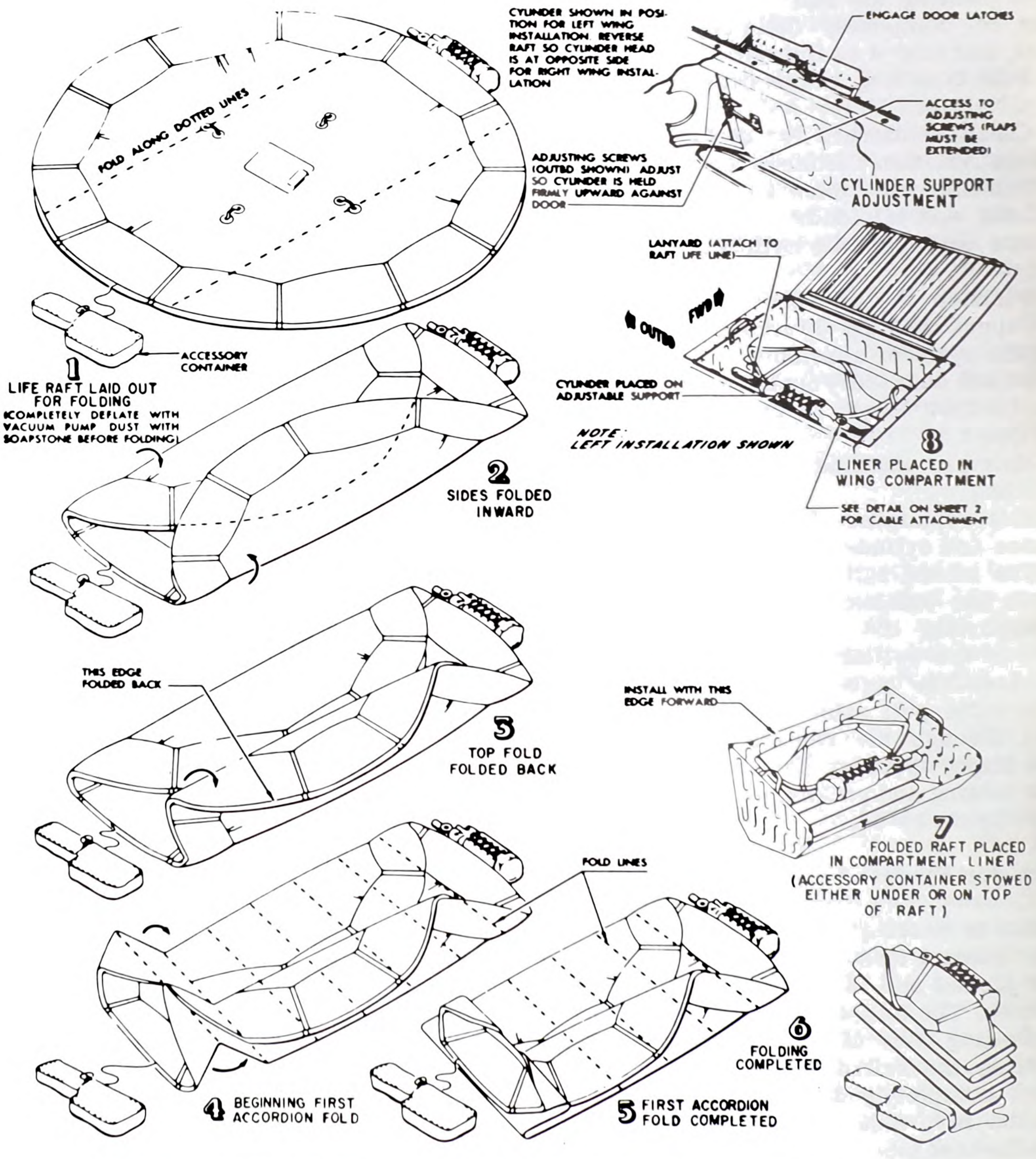

CYLINDER SHOWN IN POSITION FOR LEFT WING INSTALLATION. REVERSE RAFT SO CYLINDER HEAD IS AT OPPOSITE SIDE FOR RIGHT WING INSTALLATION
ENGAGE DOOR LATCHES
ACCESS TO ADJUSTING SCREWS (FLAPS MUST BE EXTENDED)
ADJUSTING SCREWS (OUTBD SHOWN) ADJUST SO CYLINDER IS HELD FIRMLY UPWARD AGAINST DOOR
CYLINDER SUPPORT ADJUSTMENT
FOLD ALONG DOTTED LINES
ACCESSORY CONTAINER
1 LIFE RAFT LAID OUT FOR FOLDING (COMPLETELY DEFLATE WITH VACUUM PUMP. DUST WITH SOAPSTONE BEFORE FOLDING)
LANYARD (ATTACH TO RAFT LIFE LINE)
OUTBD
FWD
CYLINDER PLACED ON ADJUSTABLE SUPPORT
NOTE: LEFT INSTALLATION SHOWN
8 LINER PLACED IN WING COMPARTMENT
SEE DETAIL ON SHEET 2 FOR CABLE ATTACHMENT
2 SIDES FOLDED INWARD
THIS EDGE FOLDED BACK
3 TOP FOLD FOLDED BACK
INSTALL WITH THIS EDGE FORWARD
7 FOLDED RAFT PLACED IN COMPARTMENT LINER (ACCESSORY CONTAINER STOWED EITHER UNDER OR ON TOP OF RAFT)
FOLD LINES
6 FOLDING COMPLETED
4 BEGINNING FIRST ACCORDION FOLD
5 FIRST ACCORDION FOLD COMPLETED

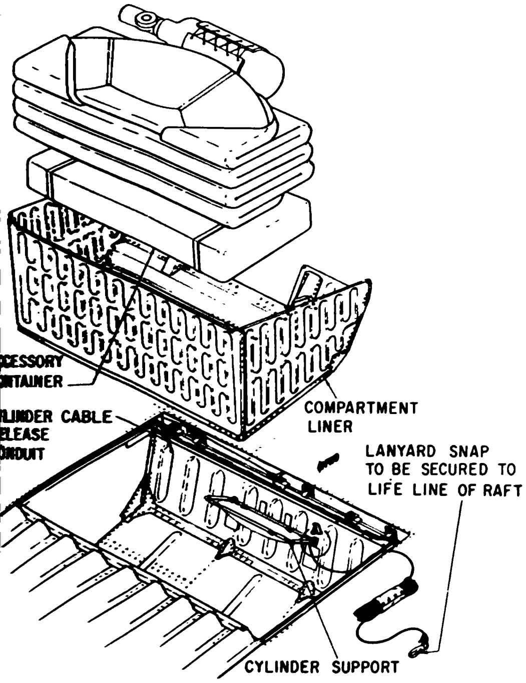
Figure 15-14.—Packing the Mk 20 raft for installation for ejection.

or a combination of both, in accordance with MIL-C-5539.

The preferred cement for use in the repair of rafts is MIL-C-5539, type B; however, when not available, type C may be used.

PATCHING PROCEDURES.—For patching holes in multiplace rafts, cut a patch of rubberized fabric large enough to extend the scalloped edges of the patch 1 1/2 to 2 inc beyond the hole or damaged area.

If the tear or cut is of sufficient siz permit the entrance of the hands and a br on the inside of the flotation tube, patch affected area from the inside as well as fr the outside. Should the damage be in the fo of a cut or tear having no material missi



igure 15-15.—Placing the folded raft into the compartment.

ot overlap the cut, but always butt one edge e cut to the other when contacting the . To prevent cement from coming in contact undamaged internal tube surfaces, use an opriate piece of holland cloth under the ged area being coated. This will keep the lite internal surface from sticking to the ired area. In some cases, the holland will have to be left inside the repaired tion tube.

aft patching procedure is as follows:

. Before scalloping, place the patch over ole and mark off the damaged area, follow- the lines of the patch. Scallop the edges e patch with pinking shears and round all ers.

. Clean the marked area and the underside e patch thoroughly with a medium stiff le brush dampened with Stoddard solvent llow the patch to dry.

Thin a small quantity of cement by adding ual amount of solvent and mix well.

Brush this thinned cement into the washed illing the edges of the tear or cut as as possible. The first application of d cement is designed to penetrate the of the fabric and thereby build a good base for the final heavier coats. After the first coat is dry, trim off all ravelings, threads, or twisted edges.

5. Apply one more coat of thinned cement; also, apply two coats of the thinned cement to the patch. Allow to dry 5 to 15 minutes.

6. Apply two additional coats of regular strength cement to the damaged surface and two coats to the patch. Allow the third coat on the respective surfaces to dry before applying the fourth.

7. When the fourth coat becomes tacky, apply the patch carefully to the damaged area so that it will not have to be torn off and reset. Lay it over the damaged area and roll it down, being careful not to trap air between the cemented surfaces. When using a steel roller, keep the roller flat so that its sharp edges will not cut the fabric.

8. Twenty-four hours after the repair, check the raft for leak tightness.

Loose seams, chafing patches, oar patches, and other similar patches can be recemented following the applicable cleaning and patching methods outlined. If, after the tape over a tube seam has been recemented in accordance with instructions, the leak still persists, seeping through the rubberized fabric near the seam, it is an indication that the seam or the tape holding the seam inside the raft is defective. In this case, survey the raft. All seam and patching repairs affecting the flotation tube of the raft must be checked for leak tightness by employing air pressure and a mercury manometer to ascertain the effectiveness of the repair.

Cleaning

If a general cleaning is necessary, the raft should be cleaned only with a mild soap. Avoid the use of coarse scrubbing brushes in the cleaning process, as this practice will damage the fabric, causing leakage. All traces of soap must be removed by a thorough rinsing with clear fresh water. After rinsing, dry the raft with a sponge. When the raft is dry, dust with talc.

To remove old cement, grease, paint, or other similar stains from the raft, it is permissible to use Stoddard solvent or some other suitable safety solvent. Extreme caution must be exercised in the use of solvents, since they dissolve rubber. When a stain cannot be removed completely, if it is not injurious to the fabric, it is better to leave it alone than to continue harsh removal methods. Any stain bears watching and should be tested for its acid or alkaline content whenever the raft is inspected.

Emergency Repairs

Emergency repair of the Mk 20 raft, when in the water, is accomplished by the use of the metal clamp type plugs provided in the accessory equipment container of each raft. No emergency repair equipment is provided with other types of rafts.

Safety Precautions

Cements and solvents are flammable materials and must be treated as such. Never smoke nor permit any type of open flame near cements or solvents when they are being used. After completion of any repair work involving these materials, always replace caps or covers as tightly as possible. The container should be stored in a cool storeroom. Common sense and a few precautions will avoid many accidents. WHEN WORKING WITH CEMENTS AND SOLVENTS, DO SO IN A WELL-VENTILATED SPACE.

Survey of Rafts

In accordance with Aviation Clothing and Survival Equipment Bulletins 17-61 and 17-61A, rafts are to be surveyed under the following conditions:

1. All multiplace rafts, pararafts, and packet rafts 8 years of age or older must be surveyed.
2. When major repairs are required, such as patching of a bulkhead, replacing a section of porous flotation tube fabric, or the opening of a flotation tube seam for other reasons, the raft must be surveyed.
3. All multiplace rafts 5 years old which fail to pass the pressure test must be surveyed.
4. Pararafts and packet rafts failing to pass the pressure check test must be surveyed unless the failure can be traced to a cut or a tear. If there is no porosity in the fabric, the raft may be repaired.

The disposition of surveyed rafts is as follows:

All usable underage fabric and accessories may be retained and used in the repair or modification of serviceable rafts. Other equipment in serviceable condition and not required for local use in making repairs or modificati should be shipped to the nearest aviation su depot for stock.

STOWAGE OF RAFTS

Pneumatic survival equipment of any should never be stowed near hot places, b teries, auxiliary powerplants, stoves, inverte or the like. Frequent inspection and occasi discipline will also be necessary in orde detect and stop pilferage of the contents of sto rafts. Nonflying squadron personnel must made aware of the dangers which may re from pilferage.

Rafts carried in aircraft not equipped raft compartments should be stowed in the fu lage in a manner and position that will re them readily available. This will save m valuable time for personnel in abandoning aircraft during a ditching. Rafts stowed in fuselage should retain their carrying ca

Because of the nature of materials use raft construction, both flight and maintena personnel should avoid sitting on rafts or pla heavy tools or other equipment on them.

DEMONSTRATING THE USE OF RAFTS

Many ditchings and water crashes occu a rough sea or at night. Only complete famili ization with the use of survival equipment give the aircrewman a chance of survival un such adverse conditions. Therefore, inten drill in the use of rafts and their associ equipment is essential for safety.

The survival officer will be concerned survival techniques and should see that a surv training program is set up in the parachute In most cases, the chief-in-charge of the will have the responsibility of setting up training. As a PR3 or PR2 you will have m occasions to participate in this training, an many instances may be completely respons for the carrying out of the program. Regardl of who is in charge and must shoulder the c plete responsibility, it is the duty of ev Parachute Rigger to be completely familiar all phases of survival training and be to demonstrate the use of survival equipm

A very effective system of training in wa survival techniques is the use of the Dilb Dunker to simulate an actual aircraft ditch as closely as possible and to teach the b escape procedure with full equipment.

lthough such complete courses of training ot be conducted in certain localities because e lack of specialized equipment, the Para- e Rigger should make every attempt to give rewmen frequent practice in the actual use e equipment. Discussions, demonstrations, shop lectures are all helpful, but working the actual raft equipment is the only way cquire the knowledge essential to survival.

ting the Raft

n demonstrating the raft's use, the most ortant thing to stress is that the retainer ard snap is firmly attached to the ring on lifevest before inflating the raft. Inflate the as soon as possible so that personnel can out of the water. Inflation of the raft is ef- ed by pulling on the short length cable ched to the CO_2 cylinder valve. After sev- hours, the CO_2 cylinder may be removed the side of the raft. It tends to chafe the of the compartment and acts as an anchor, ing the raft to orbit around it. Sometimes possible to back off the coupling between ylinder and the manifold so that the cylinder ases from the mount. Once the cylinder has removed, it will no longer be useful in way and should be thrown over the side. , of course, is under actual emergency con- ns; in a training demonstration, the cylinder ld be saved and recharged for further use on raining equipment.

n demonstrating their use, instructions ld also be given on manual inflation of rafts. othing happens after the CO_2 cable has been ed, the carrying case should be pulled off the raft unfolded so that the hand pump in oar pocket will be accessible. After the p is removed, the first compartment to be ted should be the seat. This will help keep raft afloat so that the remaining compart- ts can be inflated with the pump. In attach- the pump, care must be taken not to screw pump too tightly to the valve. If it is too , it may freeze and be impossible to loosen out some type of wrench or pliers.

rding the Raft

The best way to board the multiplace raft is rasp the boarding handle, kick feet vigorously le pulling elbows and lifevest over the raft . Then grasp the inboard boarding handle, pull and roll the body into the raft. Another way of boarding the raft is illustrated in figure 15-16. This method is more satisfactory when boarding the PK-2 pararaft. Boarding by going over the end rather than the side, lessens the possibility of capsizing the raft.

If the raft should capsize, it is best to approach it from the side on which the CO_2 cylinder is installed. The survivor reaches across the raft and grasps the righting handle farthest from the cylinder. Then, by sliding back into the water and pulling on the righting handle at the same time, the raft will turn right side up. By this method, there will be no chance of the CO_2 cylinder hitting the survivor when he rights the raft. (See fig. 15-17.)

Another important point to remember in righting the raft is to note the surface winds and take advantage of them. It is very hard to right a raft against the wind.

Safety Precautions in Boarding Rafts

Extreme care should be taken when boarding rafts or assisting personnel into the raft from the water. This is particularly so if such persons are wearing parachute harness or lifevests. Once in the raft, all personnel should seat themselves on the floor and remain in that position if at all possible. Movement within the raft should be restricted as much as possible to keep friction at a minimum. All sharp objects should be collected and stored, especially jeweled rings, wrist watches, etc. All loose articles of equipment should be properly packaged to protect the raft fabric.

PK-2 PARARAFT KIT

The pararaft kit (PK-2) is a one-man raft. The methods of rigging the pararaft to the various types of parachutes have been discussed in other chapters of this training course. This section is therefore limited to describing the components of the PK-2 and its equipment and the procedures for performing inspections and maintenance. Procedures which parallel those already outlined for multiplace rafts are not repeated.

FLOTATION TUBE

The body of the pararaft consists of an encircling buoyant tube tailored to form the shape shown in figure 15-18. The flotation tube is made in one continuous chamber from type N fabric.

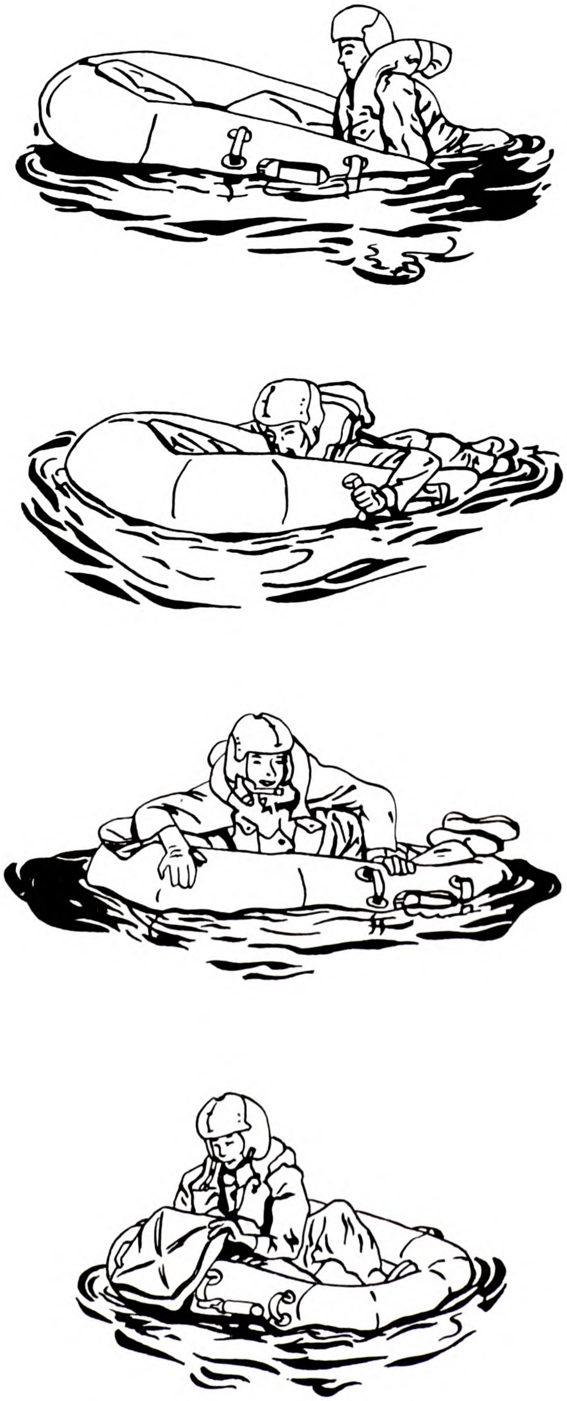


Figure 15-16.—Boarding the raft.

There are no internal bulkheads as in the mult place rafts. The fabric bottom is applied with sufficient amount of slackness to prevent di tortion of the flotation tube when the raft inflated.

SEAMS

All laps used in the seam construction the flotation tube are five-eighths inch wic covered inside and out with type R tape, thre fourths inch wide.

CYLINDER CARRIER

Figure 15-18 shows the location of the cy inder carrier on the flotation tube. The cylind carrier is 2 inches in diameter.

ORAL INFLATION TUBE

The valve on the oral inflation tube clos automatically by spring pressure when it is r held open. The valve is locked shut by turni the mouthpiece in a clockwise direction. T 3/8-inch oral inflation tube is cemented to t valve at one end, and at the other it is equipp with a molded flange which is cemented to t flotation tube.

BOARDING STRAPS

Four handles or straps are provided as ai for boarding the raft.

INFLATION SYSTEM

The flotation tube is inflated with a C charge weighing 0.50 pound (± 0.01 poun The CO_2 cylinder is mounted in the cylind carrier and the cylinder valve is threaded ir the inlet check valve of the pararaft.

SEA ANCHOR

The sea anchor is tied to the pararaft moo ing line with type III nylon line, using a bowli knot; the other end is tied to the sea anch mooring patch with a square knot. The bitt ends of both knots are served with nylon thre to prevent them from untying. Before tying t knots, the ends of all nylon line are HEA FUSED to prevent fraying.

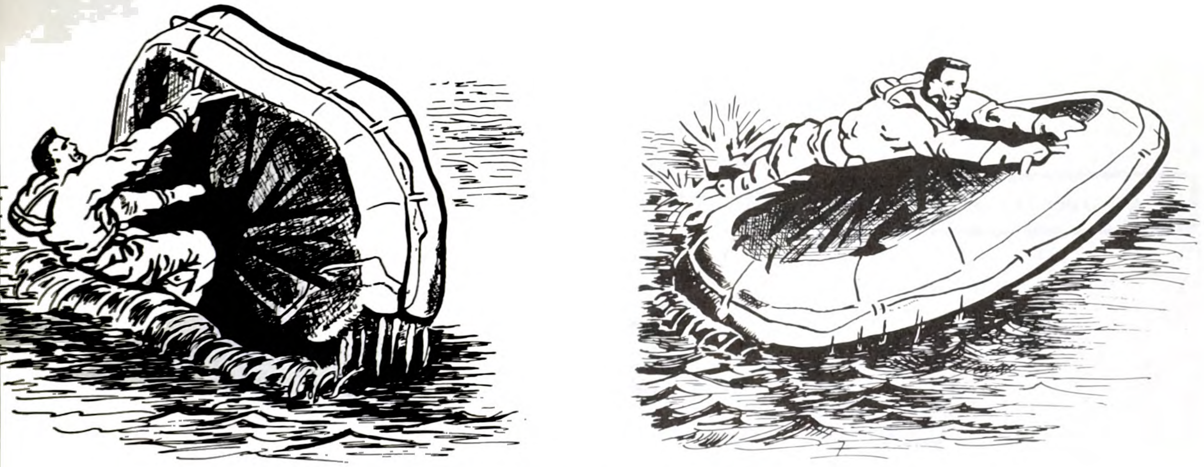


Figure 15-17.—Righting a capsized raft.

RING LINE

he securing line is a 5-foot length of nylon . This line is used to secure the pararaft s carrying case and equipment. The line is with a square knot to the pararaft sea anchor . The other end is also tied with a square through the grommet in the pararaft case. free ends of the knots are bound or sewed type B nylon thread.

BING LANYARD

nylon webbing lanyard 1-inch wide and et long is provided to secure the pararaft e user. One end of the lanyard is equipped a 1 1/8-inch snaphook. The other end is red to the CO_2 cylinder neck by means of op formed at the end of the webbing, enling the cylinder neck.

KINGS

rinted in 1/4-inch black letters on a white h adjacent to the oral inflation valve are ollowing instructions:

O INCREASE PRESSURE: PUSH DOWN
LVE MOUTHPIECE AND IMMEDIATELY
BLOW THROUGH INLET.

ach pararaft is durably marked at the large in black stencil ink with the following:

	Letter Height
PARARAFT - MODEL PK-2	1"
SPEC.	1/2"
NAME OF MFGR.	1/2"
CONTRACT NO.	1/2"
DATE OF MFGR	1/2"

PARARAFT CASE

The raft case is constructed of two-ply nylon fabric, coated on one side with a crude rubber compound. The color of the case is sage green.

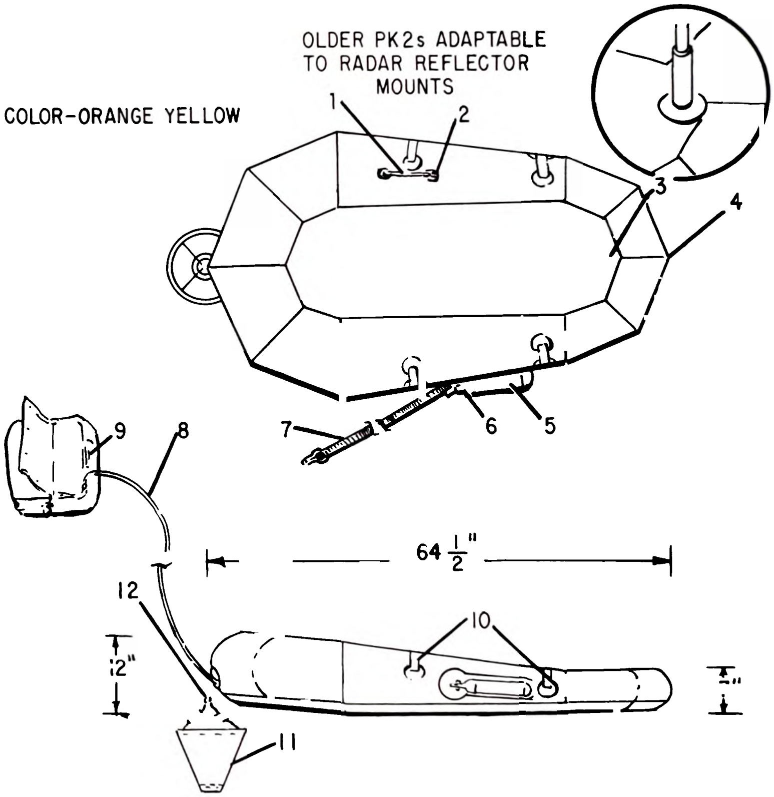
Each case is marked with black stencil paint in 1/2-inch letters. The information indicates the model number and specifications. Figure 15-19 illustrates the general appearance of the PK-2 pararaft and shows the location of the inspecting and packing data pocket. The information shown in this illustration is stenciled on the side of the case as indicated.

INSPECTION CARD

The inspection card may consist of a 3 x 5 inch printed card, containing the following information:

DATE. . . . . (date of inspection & packing)
RAFT NO . . . (raft number locally assigned)
EQUIPMENT. (completeness & condition check)
SIGNATURE . (Parachute Rigger responsible)

In addition, each card should contain information relative to the model number, specification number, and designation numbers of the publications directing modifications of the equipment.



1. Oral inflation valve tube.
2. Valve pocket.
3. Radar reflector mount.
4. Stern.
5. Cylinder carrier.
6. Cylinder.
7. Retaining webbing.
8. Securing line.
9. Raft case.
10. Handles.
11. Sea anchor.
12. Mooring sea line.

Figure 15-18.—PK-2 pararaft.

EQUIPMENT

Contractor Furnished and Installed Equipment

The following equipment is installed in the equipment section of the pararaft case: A poncho, water storage bag, and nylon line.

Government Furnished and Contractor Installed Equipment

The following equipment is installed in the equipment section of the pararaft case with the other items: A desalting kit, solar still, signaling mirror, two dye markers, and two distress signals (Mk 13 Mod 0).

Government Furnished and Installed Equipment

One MX-137A/A radar corner reflector installed in the equipment section of the pa raft case. This reflector is smaller than the used in multiplace rafts. A copy of the Gro Air Emergency Code is installed in the pa raft case inspection card pocket, along with inspection card.

To make the pararaft adaptable for riggin parachutes, a pararaft kit container is provi with each pararaft case. In spite of the f that both the pararaft case and pararaft co tainer contain something, do not confuse the The kit container contains the case, which co tains the pararaft and equipment. Each contai

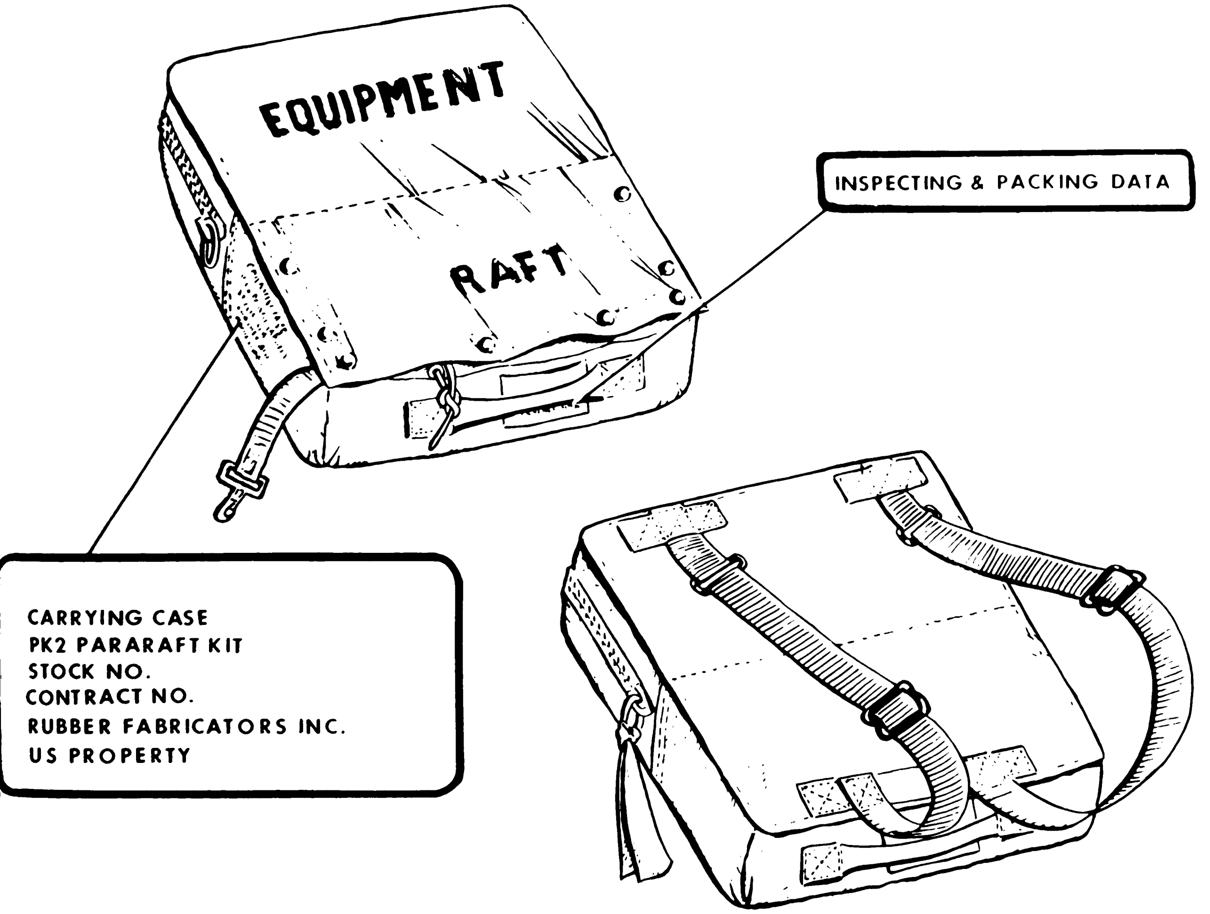


Figure 15-19.—PK-2 pararaft case.

marked in black stencils, 1-inch high, as lows:

RARAFT KIT CONTAINER FOR USE WITH
MODEL PK-2 PARARAFT KIT.

re 15-20 illustrates the stowage arrange- t of the contents in the equipment section of pararaft case. Also shown in this figure is pararaft kit container. The weight of the re pararaft assembly, including the equip- t and container, is approximately 23 pounds.

PECTION

Pararaft kits are inspected at the following es:

Prior to being placed in service.
Every 3 months after being placed in service.
Every 6 months in storage.

Pararaft kits that are rigged to seat type parachutes require a closer inspection than those rigged to the chest type because of the weight imposed upon them. The individual's weight causes trouble in the form of chafed and badly damaged materials, bent objects, and an overall impacted condition. Every time parachutes containing pararaft kits are repacked, the equipment should be rearranged and inspected closely, keeping weight factors in mind.

In addition to the trouble caused by the applied weight, another consideration is also important. This concerns flatness and smoothness of the entire assembly. An improperly packed pararaft

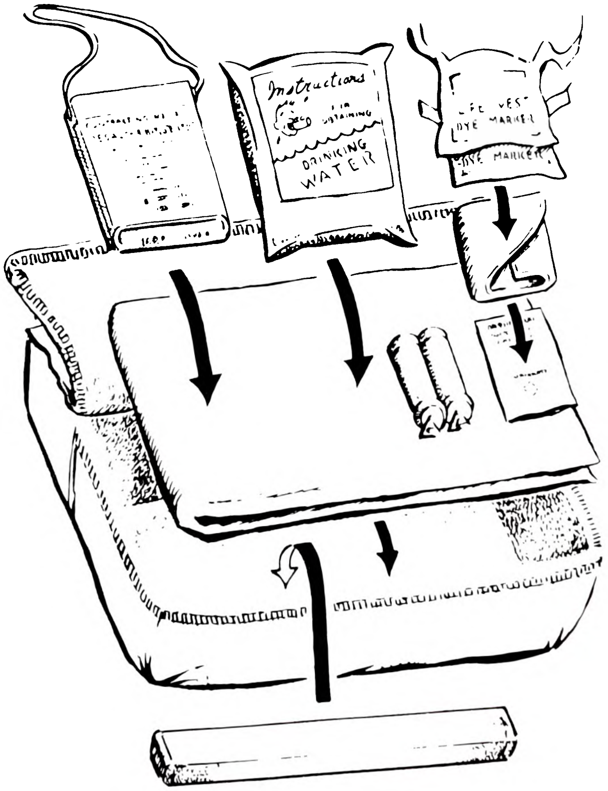


Figure 15-20.—Stowage arrangement of the pararaft equipment.

causes discomfort and fatigue to those who sit on them, even though they are separated by a cushion containing a metal pan.

When pararafts are being used every day, inspect the condition of each pararaft where the cylinder is liable to chafe the raft fabric. Chafing gear sometimes shifts or is worn through when subjected to hard usage. Also examine the inlet valve, where it joins the tube, for cracks or signs of breaking away. This inspection does not require the removal of the raft from its case, only the opening of the front section of the case.

The procedure for inspecting and testing the pararaft are the same as those given for the multiplace rafts (refer to ACSEB 17-61). Where there are considerable differences in their construction, certain steps may be eliminated or added as necessary. For example, pararafts are not constructed with internal bulkheads. Since there is only one continuous flotation tube, the internal bulkhead test is not necessary the pararaft. The pararaft is fitted with an or inflation tube, but it serves the same purpo as the topping-off valves on the multiplace raf Therefore, the same general consideratio given the topping-off valves should be appli to the oral inflation tube. Although the expos end of the oral inflation tube has no rough edge it is kept in a supporting pocket.

PACKING

Prior to commencing the packing procedu make certain that the pararaft is complete deflated. Careless or improper deflation of i flatable equipment will result in expansion high altitudes, causing severe discomfort danger to personnel and aircraft. Higher alt tudes cause progressively greater expansio Entrapped air which merely causes discomfo at 25,000 feet may pin a pilot in his cockpit higher altitudes. Deflation may be adequate accomplished by use of a suction pump su as an ordinary household vacuum cleaner.

Figure 15-21 illustrates the sequence of ste in packing the PK-2 pararaft. Each item in t equipment side of case should be secured train to prevent loss. The looped end of t webbing lanyard, attached to the cylinder nec must not interfere with the action of the valv pull. The valve pull-toggle must be placed an accessible position. After the packing is com pleted, the packer must sign the packing ca enclosed in the pararaft case.

A high-speed container has been designed fo use with the PK-2 pararaft kit when it is use in conjunction with integrated type parachute (See chapter 14 for detailed information.)

Pilot's Emergency Beacon AN/PRT-3

When the high speed container is used, th radar reflector is removed from the paraara kit and is replaced with the pilot's emergenc beacon AN/PRT-3. The installation procedur is given below:

1. After removal of the raft and equipmen install three studs on the webbing straps of th container.
2. Fabricate three loops from three strip of nylon tape MIL-T-5038, 1/2 inch by 3 inche and install snaps in loops.
3. Fabricate pockets for the beacon an battery and attach both to the equipment con tainer. (See fig. 15-22.)

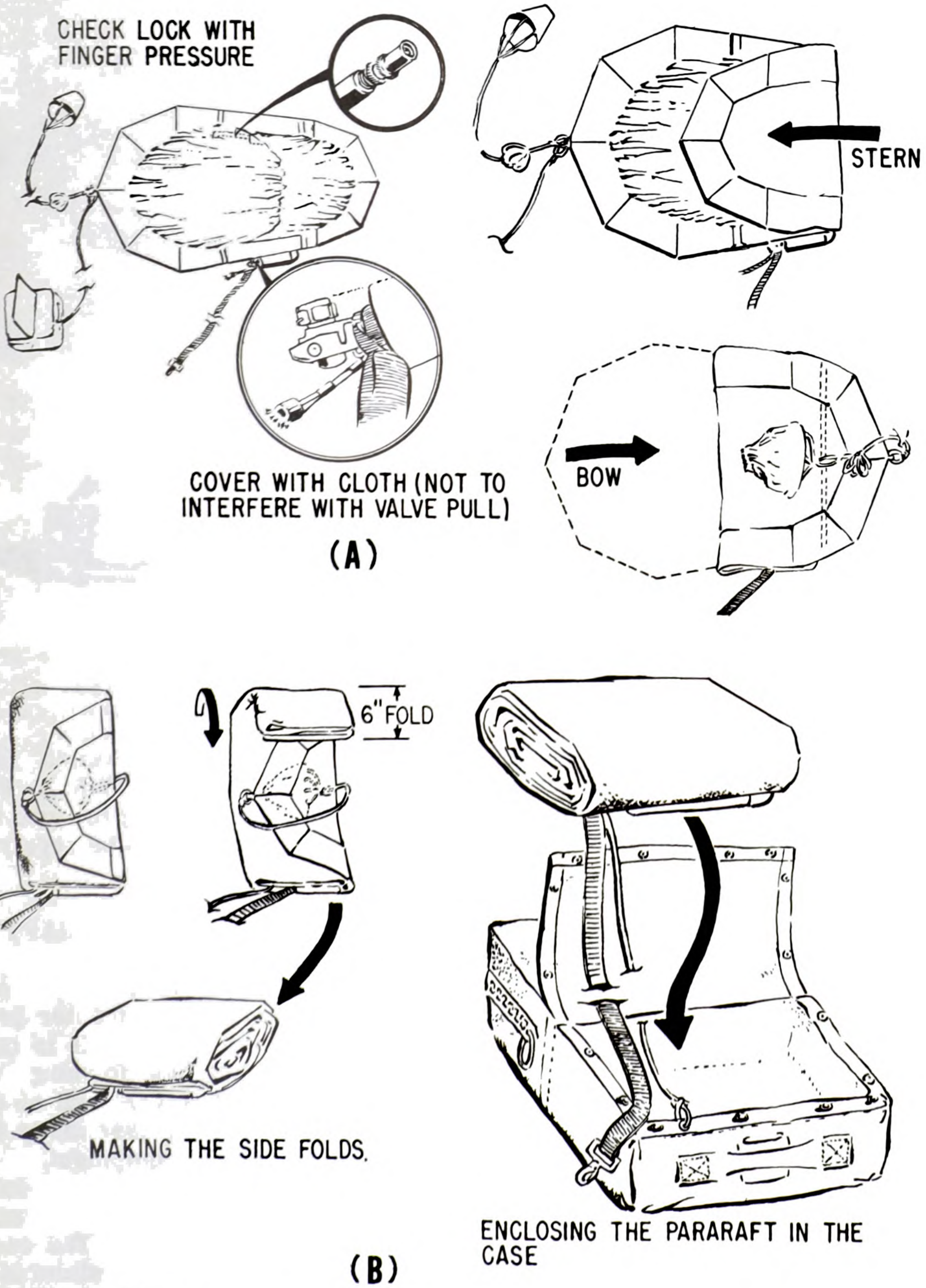

CHECK LOCK WITH FINGER PRESSURE
STERN
COVER WITH CLOTH (NOT TO INTERFERE WITH VALVE PULL)
BOW
(A)
6" FOLD
MAKING THE SIDE FOLDS.
ENCLOSING THE PARARAFT IN THE CASE
(B)

Figure 15-21.—Sequence of steps in packing PK-2 pararaft.

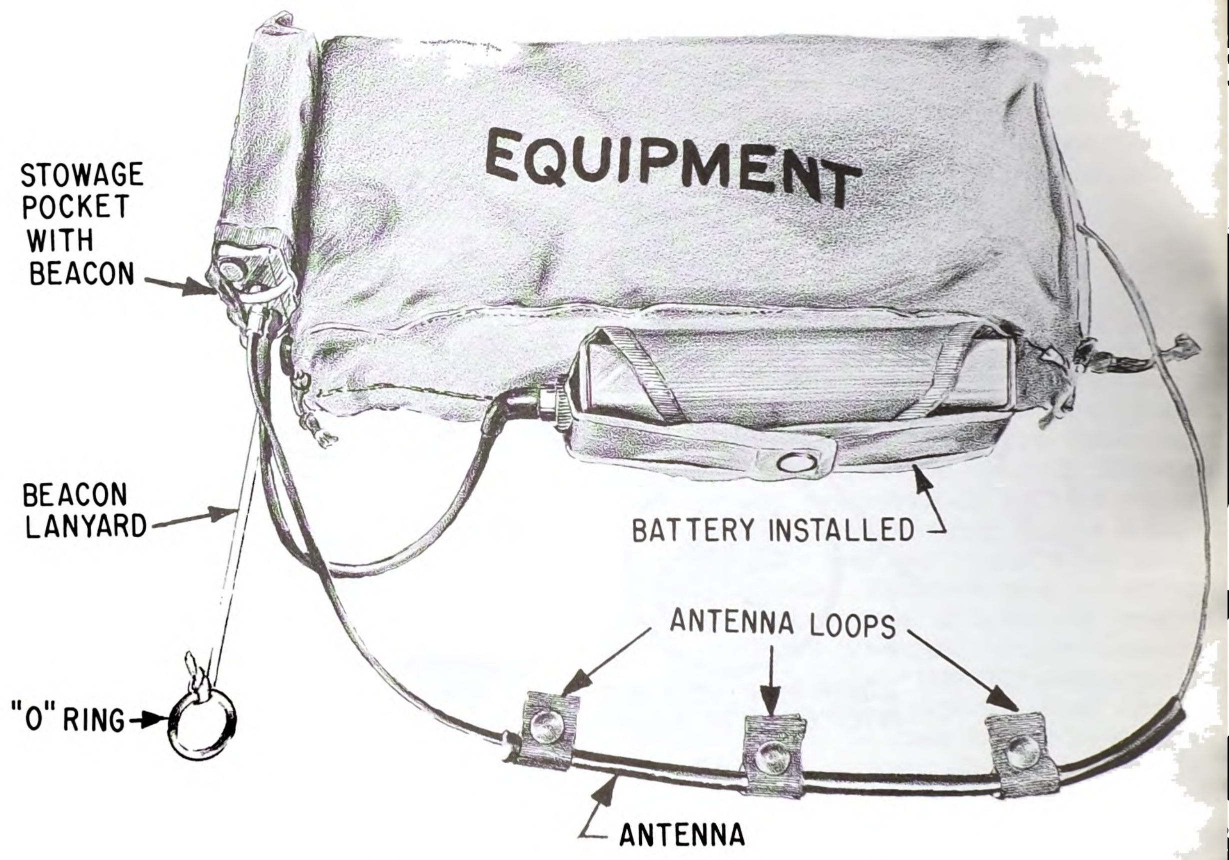


Figure 15-22.—Attachment of pockets for AN/PRT-3.

4. Install beacon and battery in the pockets and arrange equipment in packing sequence. Stow in pararaft container, allowing antenna and lanyard to project from the container flap as shown in figure 15-23.

Complete instructions for installation of the AN/PRT-3 beacon in the various type parachutes may be found in the following Aviation Clothing and Survival Equipment Bulletins:

38-60	NB-5, NB-6, NB-7, and NB-8
39-60	Martin-Baker
40-60	NS-3
17-62	NB-9

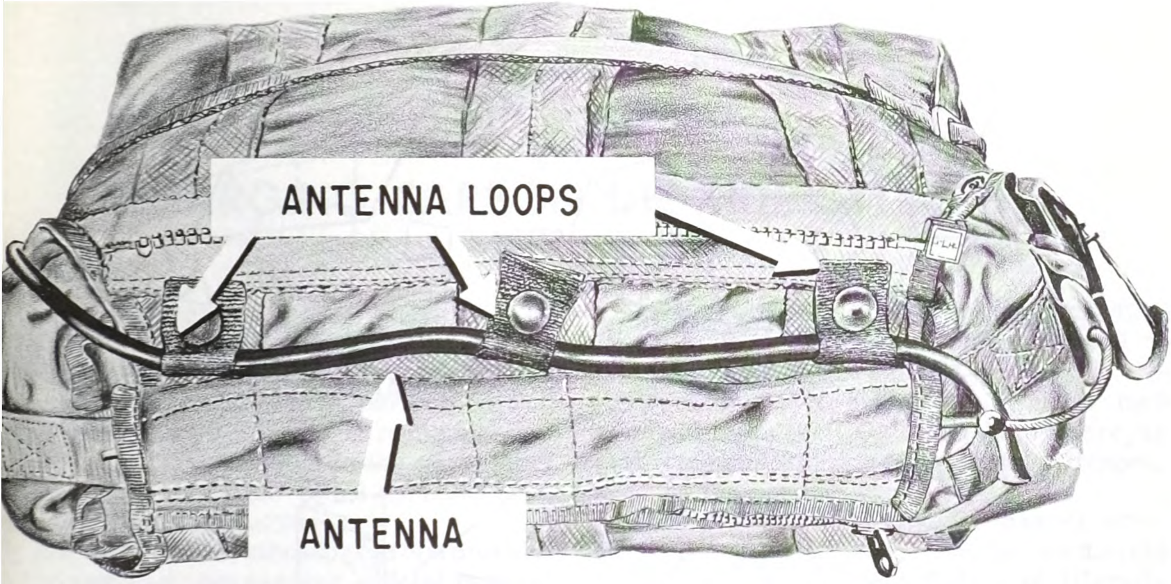
MAINTENANCE

Repair and cleaning of the PK-2 pararaft is the same as that given for multiplace rafts except that for patching purposes, type N fabric is used with the lightweight fabric of t pararaft. (See ACSEB 17-61.) Flotation tu seams and seams joining the tube to the botto of the pararaft are not to be repaired.

PR-2 PACKET RAFT

The PR-2 packet raft is a one-man ra intended for use by helicopter personnel wh are forced down at sea. It is made up of a encircling buoyant tube forming a single flotation chamber with a CO_2 and an oral inflatio system. This raft is essentially the same a the PK-2 without the equipment.

It is packed in a nylon carrying cas equipped with a shoulder and waist harnes for underarm attachment. The case is close by a slide fastener, with the slider of the fastene secured to the operating cord of the CO_2 inflation valve. When closed, the slider is positioned fo



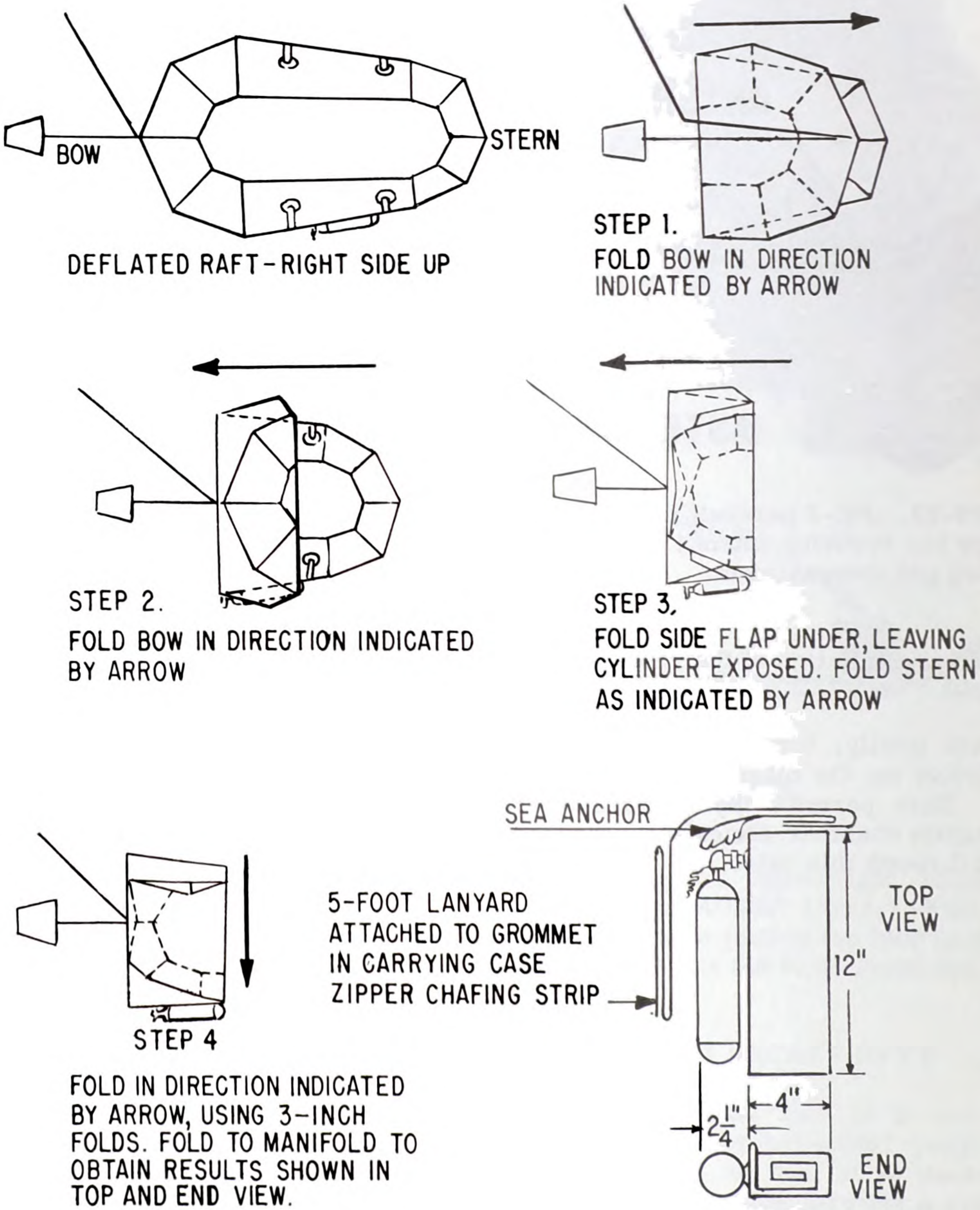
igure 15-23.—PK-2 pararaft high-speed container showing installation of studs in webbing straps for securing antenna after it emerges from the container and is routed through the locking pin compartment.

release and inflation of the raft by a sharp ward pull.

o inflate orally, turn the knurled sleeve and press on the mouthpiece to open the valve. This permits the passage of air the flotation chamber. Excess pressure may eleased through this valve.

The CO_2 inflation assembly is composed of an inflation valve, an inlet check valve, and a 20.4 cubic inch CO_2 cylinder. The cylinder is charged with 0.50 pound (plus or minus 0.01 pound) of CO_2. Use only identical cylinder for replacement.

The packing procedure for the PR-2 packet raft is illustrated in figure 15-24.



DEFLATED RAFT-RIGHT SIDE UP

STEP 1.
FOLD BOW IN DIRECTION INDICATED BY ARROW

STEP 2.
FOLD BOW IN DIRECTION INDICATED BY ARROW

STEP 3.
FOLD SIDE FLAP UNDER, LEAVING CYLINDER EXPOSED. FOLD STERN AS INDICATED BY ARROW

STEP 4
FOLD IN DIRECTION INDICATED BY ARROW, USING 3-INCH FOLDS. FOLD TO MANIFOLD TO OBTAIN RESULTS SHOWN IN TOP AND END VIEW.

Figure 15-24.—Folding and packing the PR-2 packet raft.

CHAPTER 16

RECHARGING CARBON DIOXIDE CYLINDERS

arbon dioxide gas was first discovered by Van Helmont (1577-1644), but it was not a century later that A. L. Lavoisier (1743- lemonstrated its nature by burning carbon ygen. Carbon dioxide is a component of tmosphere. It is formed in the process of iration, in combustion of all carbonaceous rial, and in fermentation.

O_2 (the chemical symbol for carbon dioxide) colorless gas, possessing a faint pungent and a slightly acid taste. It does not burn does not ordinarily support combustion. ever, metals such as magnesium, when ed, will continue to burn in it while giving oxides and liberating carbon. CO_2 gas is times heavier than air and requires only essure of 600 psi below a temperature of F to liquefy. It can be condensed into a rless liquid and stored in this state under sure in cylinders. When the cylinder valve pened, gaseous CO_2 escapes and, because e rapid drop in pressure and temperature, s carbon dioxide snow. This snow, when pressed into blocks or cubes, is what we as dry ice. Dry ice, in solid form and mospheric pressure (14.7 psi), evaporates, aining at -110° F until it disappears. It is llent for specialized refrigeration.

here are many natural carbon dioxide wells he earth's surface. Yellowstone National has several of these wells. In some caves O_2 is so dense that animals are suffocated they wander into them. Since CO_2, in tion to being heavier than air, is both ible and practically odorless, it presents a icular hazard. As in caves, it tends to ect in low, unventilated places, such as w decks aboard ship. Men encountering these itions run the risk of smothering to death. ll percentages of carbon dioxide will cause iness and perhaps headaches. Experiments shown that a 3 percent concentration of in the air will double the breathing effort, 5 percent will cause panting, 8 percent will cause marked distress, and 10 percent will cause unconsciousness very quickly.

Treatment of exposed personnel includes removal from the CO_2 laden atmosphere, artificial resuscitation, administering oxygen, and keeping the patient warm.

The Parachute Rigger's association with carbon dioxide is mainly in the recharging of cylinders used in the inflation of liferafts and those used in aircraft fire extinguishing systems. The servicing of CO_2 firefighting equipment commonly used at shore establishments and aboard ship is not a part of the PR's duties.

Carbon dioxide is ordinarily procured from local commercial sources. In some locations the Navy manufactures its own. CO_2 is purchased or accounted for by the pound, since it is measured in a liquid state. Gas (CO_2 not in a liquid state) is measured on a volume basis and purchased by the cubic foot.

Standard supply cylinders are designed to contain 50 pounds of carbon dioxide and are procured through normal supply procedures. As an example, an order for 300 pounds of CO_2 would indicate a request for 6 supply cylinders.

CO_2 RECHARGE EQUIPMENT

Carbon dioxide recharge equipment is manufactured for the Navy by several different companies. The two most widely used units are those manufactured by the C-O-TWO Company of Newark, New Jersey, and the Walter Kidde Company of Belleville, New Jersey.

A typical C-O-TWO recharge unit is shown in figure 16-1 and consists of a supply cylinder containing 50 pounds of CO_2, a tilting rack for inverting the supply cylinder, a motor-driven pump, a rack for inverting the cylinder being recharged, a scale for determining the weight

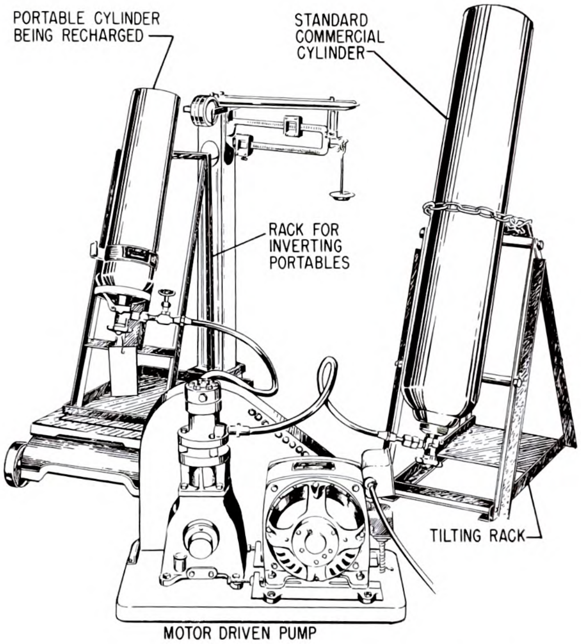

PORTABLE CYLINDER BEING RECHARGED
STANDARD COMMERCIAL CYLINDER
RACK FOR INVERTING PORTABLES
TILTING RACK
MOTOR DRIVEN PUMP

Figure 16-1.—C-O-TWO recharge or transfer unit.

of the cylinder being recharged, and the necessary high-pressure hoses, control valves, adapters, etc., to properly hook up the equipment.

Before learning the operation of any specific type of recharge equipment, the Parachute Rigger should be familiar with the following general information, which applies to all units.

Carbon dioxide recharge equipment will pump CO_2 in its liquid state only, and the amount of liquid CO_2 a cylinder contains will vary with the temperature and pressure. For example, a standard 50-pound supply cylinder contains approximately 38 pounds of liquid CO_2 and 12 pounds of gaseous CO_2 at a temperature of 70° F. It follows, then, that the cooler the supply cylinder and cylinder being recharged, the more efficient the operation of the transfer equipment. For this same reason, the time required to recharge an empty cylinder increases with the temperature of the cylinders.

When recharging a cylinder, it will remain cooler and may be filled faster if inverted, rather than left in an upright position. Large cylinders, which are impractical to invert, may be placed in a horizontal position for charging.

Standard commercial supply cylinders in 50-pound sizes are obtainable with or without a syphon tube. When transferring from a cylinder without a syphon tube, the cylinder must inverted. Supply cylinders with syphon tu should be maintained in an upright position, more than 60 degrees from vertical.

After all the liquid CO_2 has been transfer from a supply cylinder (approximately 80 perc of net contents), the efficient transfer of will cease. Then, a new fully charged sup cylinder must be used to finish charging cylinder to its fully rated capacity. The ma part of the CO_2 remaining in the supply cylin can be used when recharging another em cylinder, as the CO_2 will transfer itself un its own pressure until the pressure in b cylinders is equal. In this manner, the m economical use of the supply cylinder conte is made.

C-O-TWO TRANSFER UNIT

The general procedure for operating C-O-TWO unit shown in figure 16-1 is descri in the following paragraphs. For more compl details on erection, operation, and maintena of the unit, reference should be made to Operat and Maintenance C-O-TWO Transfer Unit, N Aer 19-1-516.

General Operating Instructions

1. Connect the pump inlet hose to the sup cylinder outlet.
2. Connect the pump outlet hose to recharging adapter on the cylinder to be charged. The pump outlet valve is fitted wit shutoff valve.
3. Check all connections and make cert that they are properly and securely made This is very important. When making up co nections, use a 12-inch wrench with a sl steady pull. Do not jerk or hit the wrench w a hammer.
4. Make certain that the shutoff valve in pump outlet hose is in the tightly closed positi and that the valve of the cylinder being recharg is in the open position.
5. Fully open the valve of the supply cylind
6. Place the empty cylinder on the scale.
7. Carefully determine the net capacity a the total weight of the cylinder to be recharg and set the scale to equal the fully charg weight shown either on the side of the cylind valve, on the cylinder, or on the namepla band.

. Open the shutoff valve in the pump outlet and allow the CO_2 in the supply cylinder ansfer to the cylinder being recharged under wn pressure.

. After the CO_2 has stopped flowing into cylinder being recharged under its own sure (the weight of the cylinder being re- ged will stop increasing), start the transfer and watch the scale carefully.

. When the full capacity of the cylinder recharged has been reached, perform the wing operations in rapid succession:

a. Stop the transfer unit motor.
b. Tightly close the shutoff valve in the pump outlet hose.
c. Close the valve of the cylinder being recharged.

TION: Do not close the cylinder valve or shutoff valve while the transfer unit is ping.

. Disconnect the hose from the cylinder recharged. Do this very slowly so as to the pressure trapped between the shutoff e and the cylinder being recharged to pe. Remove the adapter.

. Weigh the recharged cylinder carefully.

. After recharging is complete, close the ly cylinder valve tightly and open the shutoff e in the pump outlet hose very slowly, allow- all the gas in the pump to discharge to osphere.

OTE: This transfer unit is to be used for on dioxide only. Do not use for oxygen or r gases.

TER KIDDE RECHARGE UNIT

nother widely used CO_2 recharge outfit is Walter Kidde (fig. 16-2). This unit is supplied plete with the necessary adapters, valves, ty discs and bushings, nuts, bolts, and hers for making connections to the cylinder be recharged; connections to the supply nder; and the tools for making minor adjust- ts to the unit. The motor is equipped with a ty switch.

The following operating instructions are eral in nature. For detailed instructions on arging specific types of cylinders, reference uld be made to Operation and Maintenance de CO_2 Recharge Pump, NavAer 19-1-501.

eral Operating Instructions

1. Connect strainer adapter to the supply nder outlet then make up coupling adapter nut (part No. 6071) securely. Make up coupling nut (18150) to the recharging adapter, using washer (6139) between these items. (See fig. 16-3.)

2. Be sure that the cylinder valve is open and ready for charging.

3. Place the cylinder to be recharged on the scale and note reading.

4. Open shutoff valve (24650) fully; make certain blowoff valve (24650) is fully closed. Start the recharge pump.

5. Open the supply cylinder valve fully, keeping constant check on the weight of the cylinder being recharged.

6. When the cylinder is charged with the proper weight of CO_2, stop the pump and close the shutoff valve securely.

7. Close the valve on the cylinder being recharged, then open blowoff valve.

8. Check the final weight of charged cylinder.

9. Close the supply cylinder valve securely. Relieve the pressure in the recharging pump and connections by opening the shutoff valve.

CO_2 SUPPLY CYLINDERS

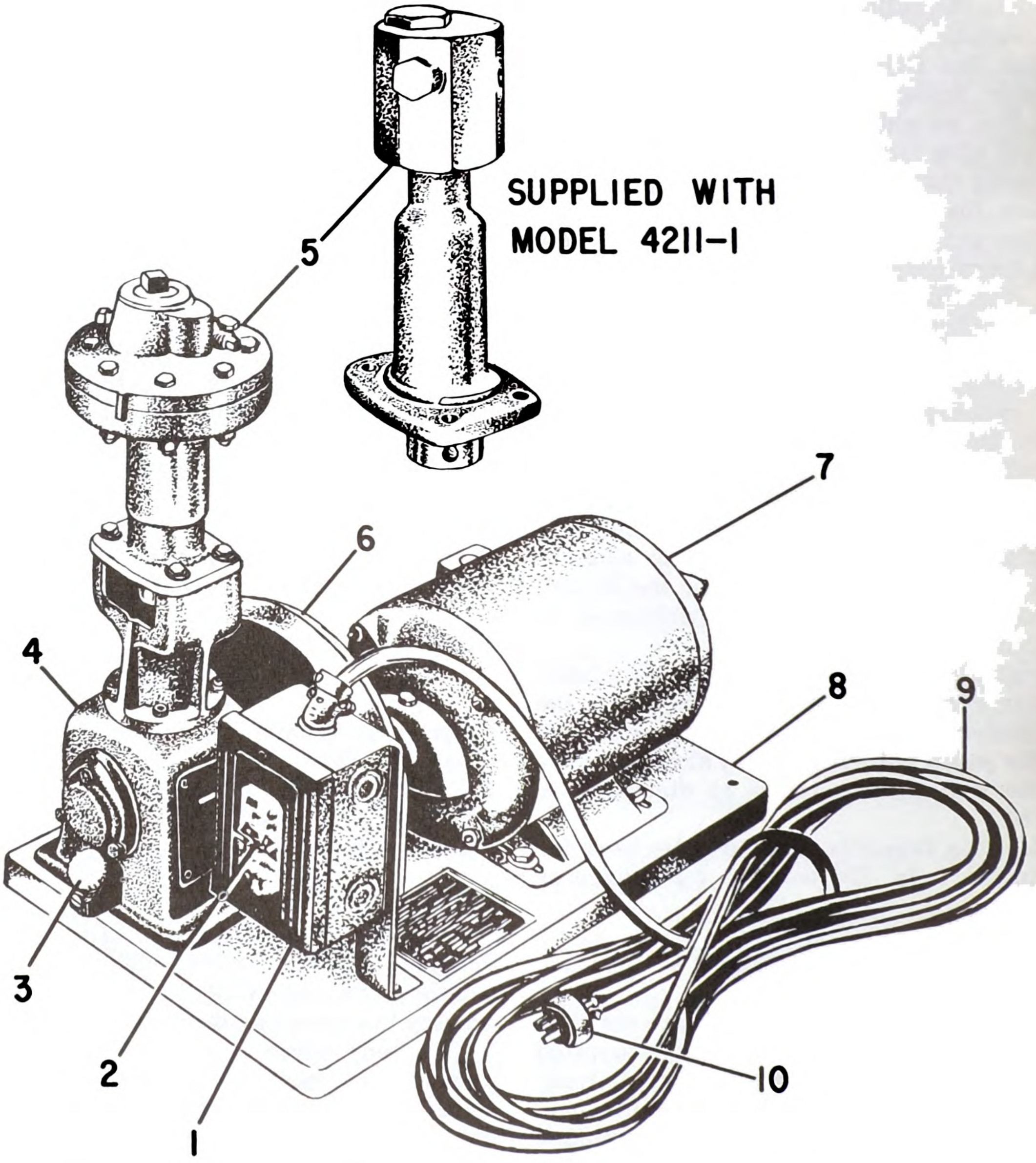
Figure 16-4 illustrates the standard supply cylinder used universally in recharging various types of CO_2 cylinders. A cutaway view of the cylinder valve is also shown. Table 16-1 lists some of the most pertinent data concerning supply cylinders.

Cylinder Valves

Navy standard valves are of two basic designs: Packed valves and diaphragm type packless valves. CO_2 handwheel type valves employ the packless design.

Packed valves require a packing material around the valve stem to prevent leakage, whereas valves (used mainly in high-pressure cylinders) are sealed against leakage around the valve stem by flexible metallic diaphragms securely clamped to the valve bonnets.

The basic packless design may be classified into two types: (1) the NON-BACK-SEATING type, which is designed so that the metallic sealing diaphragms may NOT be replaced UNDER PRESSURE, and (2) the BACK-SEATING type, in which the metallic diaphragms may be replaced without undue hazard or loss of contained gases, provided the outlet cap is in place and secure. Replacement of diaphragms in packless valves should be done only by activities carrying spare diaphragms specifically

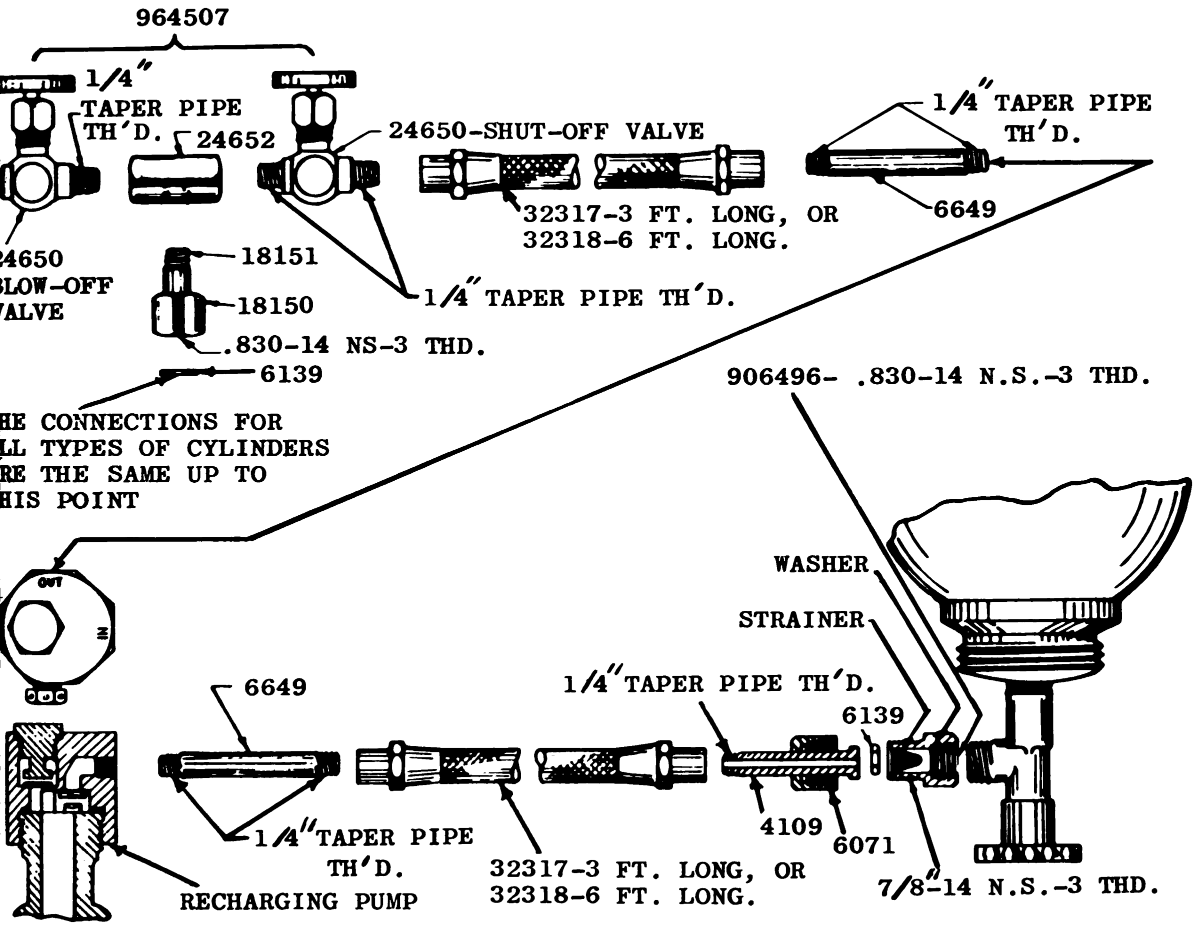


1. Multibreaker.
2. Power switch.
3. Oil filler cap.
4. Running gear assembly.
5. Compressor assembly.
6. Gear guard.
7. Motor.
8. Base.
9. Power cable.
10. Three-prong plug.

Figure 16-2.—Walter Kidde recharge unit.

designed for the valves in need of reconditioning. Diaphragms are fabricated from materials selected for service at high pressure while dynamically loaded. In addition, they are often of a design suitable only for use with valves fabricated by a given manufacturer and fo specific gas.

One of the features of the Navy gas va program (also civilian agencies) is to prov noninterchangeable valve outlets and connecti



COMMERCIAL TYPE SUPPLY CYLINDER SHOWN (NO
SYPHON TUBE). THIS TYPE CYLINDER MUST BE
INVERTED, VALVE AT BOTTOM.
WHEN KIDDE SUPPLY CYLINDER (FITTED WITH SYPHON
TUBE) IS USED, KEEP ERECT, VALVE AT TOP.
FOR BEST RESULTS KEEP SUPPLY CYLINDER COOL.
SEE RECHARGING INSTRUCTIONS.

Figure 16-3.—Basic connections for Walter Kidde unit.

different gases to prevent using the wrong at any time.

king Valves

ienerally, cylinders with leaking or defec- valves must be turned in to supply for haul. This is especially true in the case of ped threads or bent stems.

eakage is sometimes caused by the presence t or other foreign particles in the valve or valve seat. This type leakage may some- be corrected by partially opening and then ng the valve to blow out the material. If leakage continues, the cylinder should be removed to a safe place in the open, if possible, and emptied by opening the valve.

SAFETY DEVICES

Safety devices for CO_2 cylinder valves consist of an unbacked safety cap with a rupture disc. It consists essentially of a safety cap covering a safety port in the valve. The cap retains a frangible disc firmly over the safety port. Under excessive pressures ranging from 2,700 to 3,000 psi, the safety disc ruptures and allows the gas in the cylinder to vent to atmosphere.

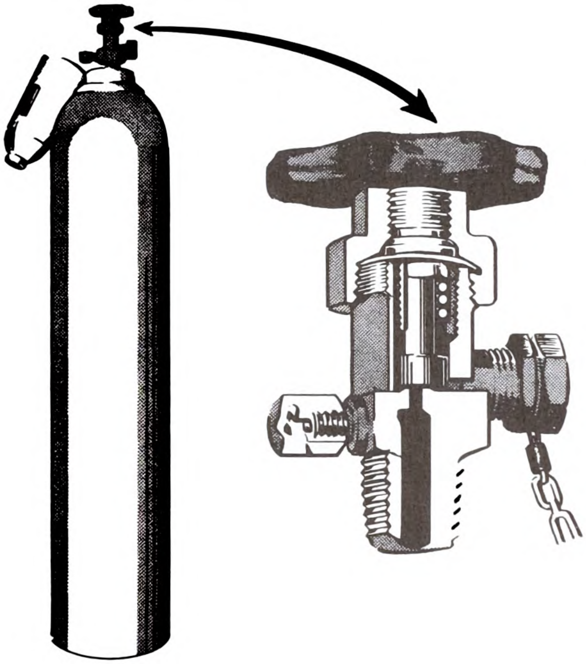


Figure 16-4.—CO_2 supply cylinders.

Table 16-1.—Supply cylinder data.

Capacity at normal pressure and temperature*	50 pounds
Working pressure	1,800 to 2,015 psi
ICC specification	ICC3A
Dimensions (approx.)	Diameter, 8 1/2 inches; length, 51 inches
Weight, empty	110 - 115 pounds
Outlet connection	3/4 inch

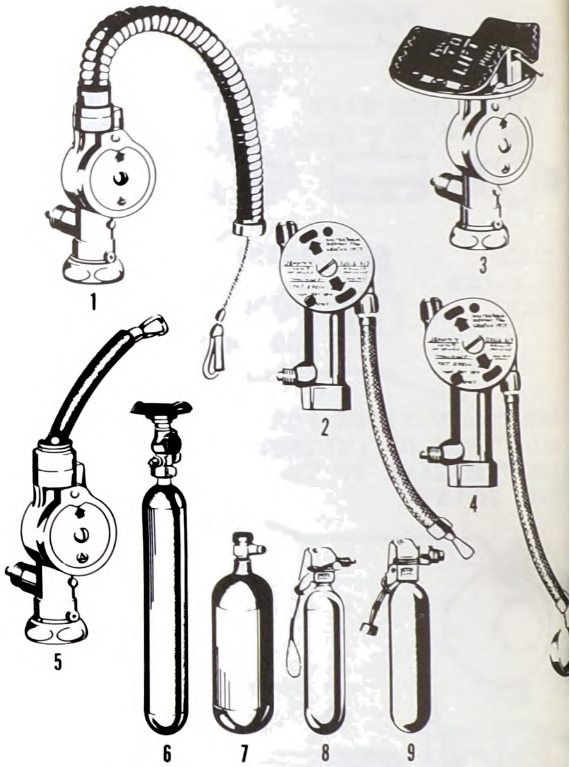
*Temperature of 68° - 70° F and atmospheric pressure.

LIFERAFT INFLATION EQUIPMENT

Figures 16-5 through 16-11 illustrate various types of liferaft inflation equipment items. These items consist of various sizes of cylinders and discharge heads and valves.

DISCHARGE HEADS

Two types of discharge heads are commonly used. These are the cutter type and the seat type. A description of the operating principles of each type follows.



1-5. Discharge head assemblies.
6, 8, 9. Cylinder and valve assemblies.
7. Cylinder and disc body assembly

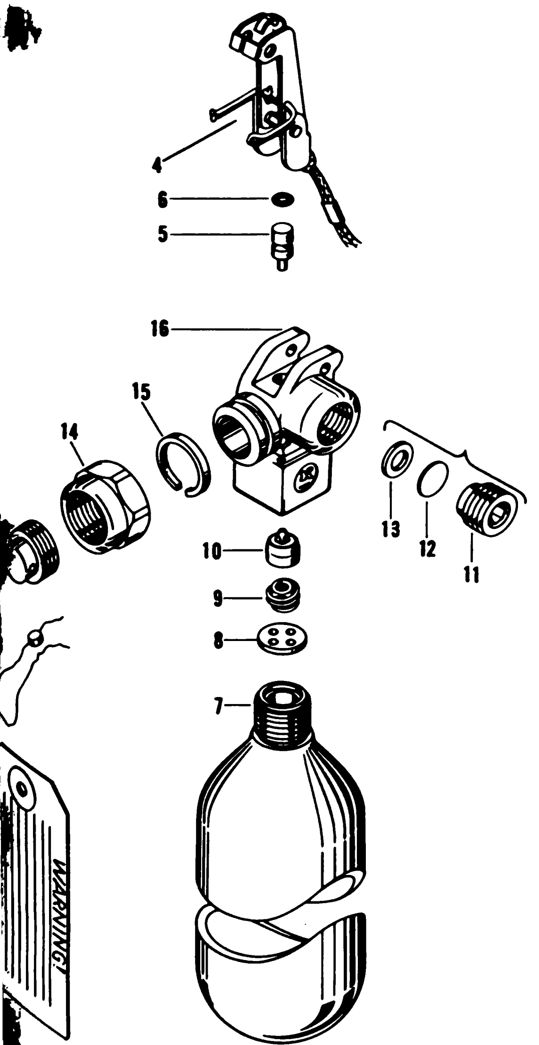
Figure 16-5.—Raft inflation equipment.

Cutter Type

Pulling a cable releases the cutter which under spring action. The cutter pierces a seali disc in the neck of the cylinder. CO_2 discharg through the ruptured disc, bypassing the cutt and passes on through the outlet into the r inflation compartment. A new disc must installed in the cylinder adapter after each u This necessitates the temporary removal of t head or bonnet during the recharging proce

Seat Type

Pulling a cable turns a cam or sheave whi actuates a stem and opens a seat, there admitting CO_2 into the raft compartment throu the outlet of the discharge head. It is r necessary to remove the discharge head f recharging after each use. A disc is r employed.



e seal.
ing tag.
oil plug. NOTE:
ome instances,
r approval, this
ing is eliminated
onserve expense
d weight.
ndle and pull
d assembly.
ger.
ng hydraulic
king.

7. Cylinder (20.4 cu in. capacity).
8. Bottle washer.
9. Check spring.
10. Check.
11. Safety disc plug.
12. Safety disc.
13. Safety disc washer.
14. Coupling nut.
15. Brass wire.
16. Valve body.

re 16-6.—Cylinder and valve assemblies used on the pararaft.

CYLINDERS

The cylinders used in conjunction with emergency equipment, designed for use in aircraft, must be shatterproof. Shatterproof cylinders are identified by a 2-inch white stripe painted on their sides. The shatterproofing is accomplished by either a heat-treating process, or by a wire wrapping which encompasses the body of the cylinder throughout most of its length. Nonshatterproof CO_2 cylinders, such as some older type supply cylinders, do not carry the distinguishing white stripe. Only shatterproof CO_2 cylinders should be used in aircraft systems and related equipment.

All liferaft cylinders are equipped with a syphon tube. The syphon tube may be the straight type or the flexible type, depending on how the cylinder is to be mounted. Figure 16-12 illustrates both types of syphon tubes.

Cylinders equipped with flexible syphon tubes are marked with a black stripe; those having a straight type are marked by a spot, as shown in figure 16-12.

All CO_2 cylinders used in connection with aircraft fire extinguishing equipment (both portable and built-in types) must be serviced to operate throughout the temperature range of -65°F to +150°F. This is accomplished by the addition of 200 psi of dry, oil-free nitrogen to each cylinder and then adding the proper charge of carbon dioxide. Cylinders charged in this manner are referred to as winterized cylinders.

Cylinders which are to be winterized are identified by a yellow dot 3/4 inch in diameter, or larger, on opposite sides of the cylinder.

The addition of nitrogen in CO_2 cylinders provides additional pressure which expels the CO_2 at extremely low temperatures at a much higher rate than would the pressure of the CO_2 itself.

CYLINDER MAINTENANCE

Cleaning and Painting Cylinders

Cylinders should never be painted colors other than those indicated in the color code for compressed gas cylinders in Military Standard 101A. When camouflage is necessary, canvas or other materials painted with camouflage colors may be placed over the cylinders.

Cylinders should never be painted on their interior surfaces.

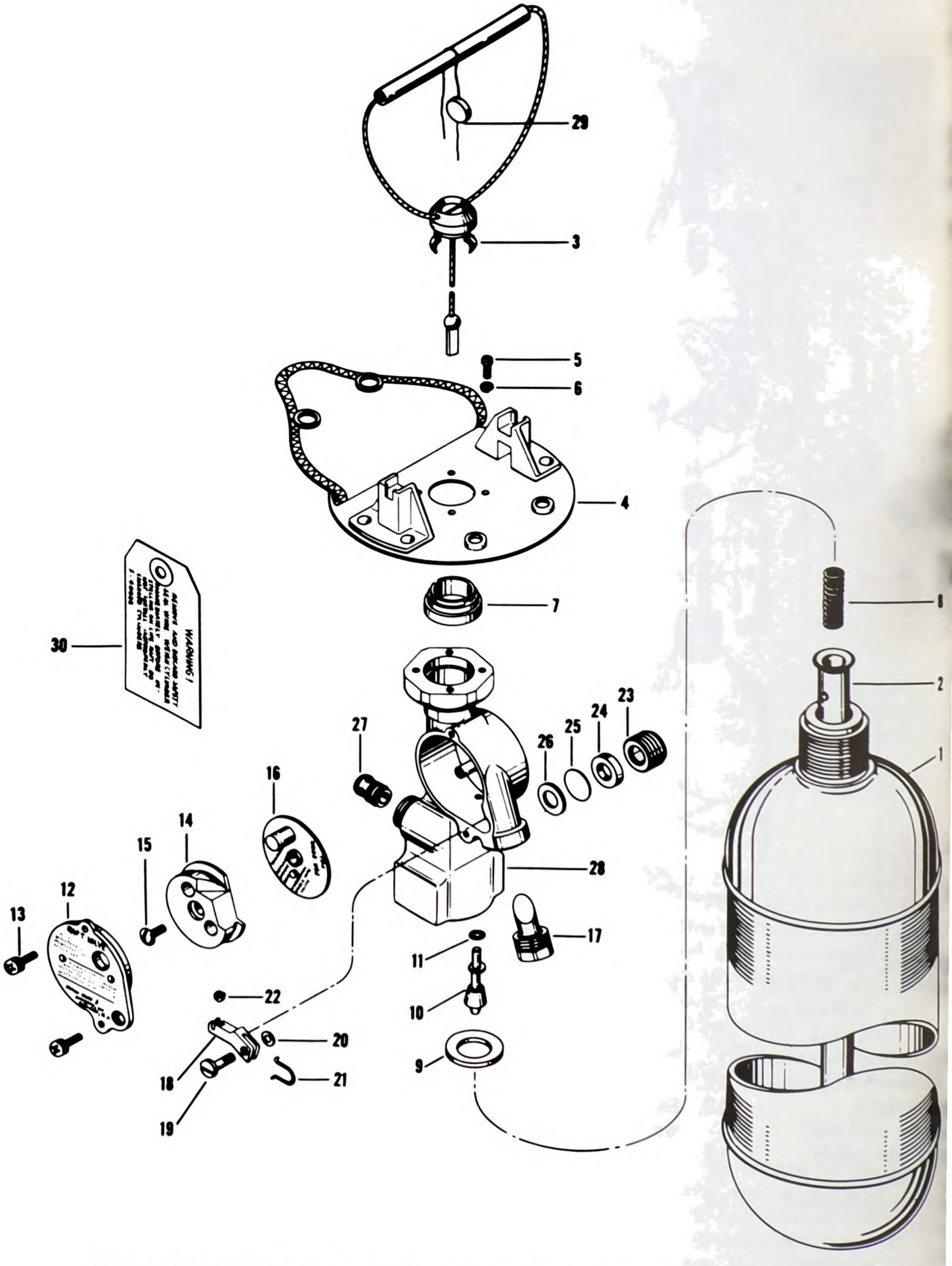
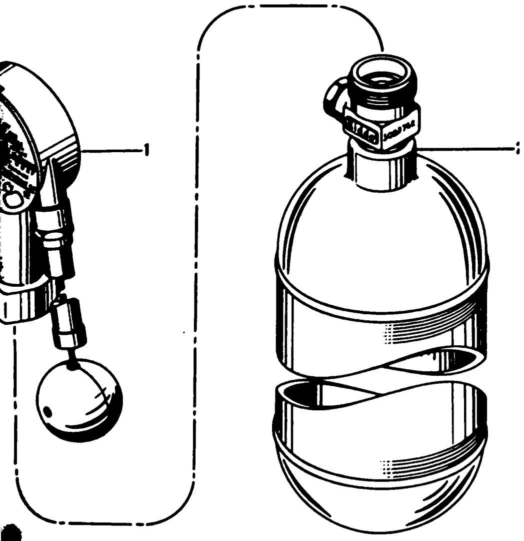


Figure 16-7.—Cylinder and valve assemblies used on multiplace liferafts. (Note that valve does not employ a cutter.)

Nomenclature for figure 16-7.

Cylinder, nonshatterable (96 cu in., 147 cu in., or 205 cu in).
Syphon tube.
Pull cable.
Guard flap and plate.
Screw.
6. Washer.
7. Retainer.
8. Spring.
9. Gasket.
10. Stem.
11. O-ring packing.
12. Cover.
13. Screw.
14. Sheave.
15. Screw.
16. Camplate.
17. Plug.
18. Lever.
19. Stud.
20. Washer.
21. Lever spring.
22. Roller.
23. Retainer.
24. Plug.
25. Safety disc.
26. Safety disc washer.
27. Recoil adapter.
28. Valve body.
29. Wire seal.
30. Tag.



ischarge head assembly (seat type).
ee fig. 16-9.)
ylinder and disc body assemblies.
ee fig. 16-10.)

16-8.—Cylinder, disc body, and dis-
ge head assemblies used on multiplace
liferafts.

ves must be kept free from paint. Navy
erstate Commerce Commission serial
and test markings must not be oblit-

e painting cylinders, all loose paint,
st, and dirt must be removed. When
oducing tools, such as wire brushes or
lic scrapers are used, the cleaning op-
n should be done in the open or in a well
ated compartment with firefighting equip-
available.

Before any cleaning operation, the valves, safety devices, and fusible plugs should be tested for leaks. Leaking cylinders should not be cleaned, but should be returned to an authorized repair activity.

Testing Cylinders

Interstate Commerce Commission regulations require quinquennial (5-year) retesting of all CO_2 cylinders. Cylinders for which prescribed retests have become due must not be recharged until retests have been properly made. Cylinders which have been charged prior to the expiration of their retest period may be shipped and used until empty before being retested.

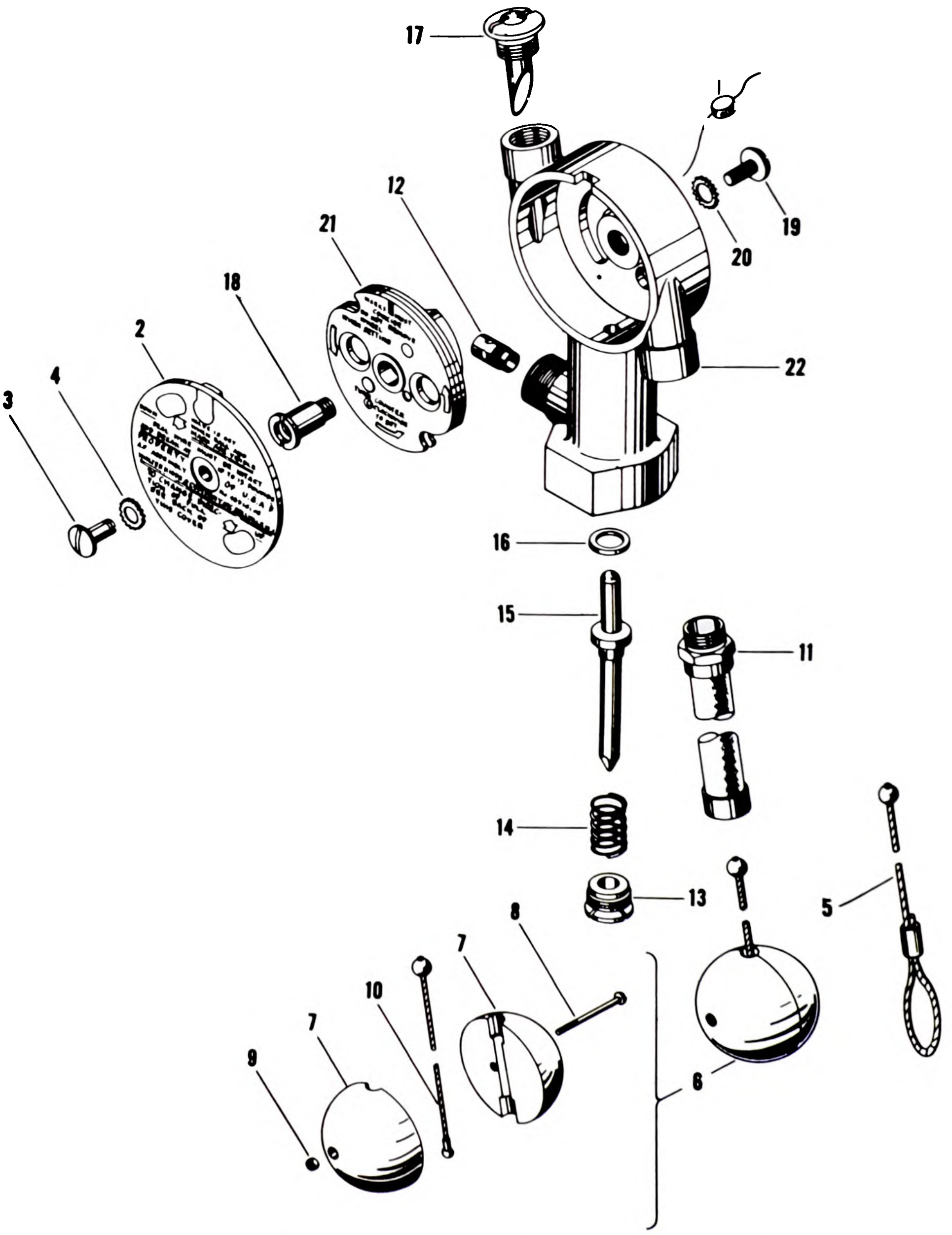
The 5-year hydrostatic tests are performed by naval and civilian establishments under regulations of the Interstate Commerce Commission, and specially approved testing equipment is required. Since ships are not authorized to conduct such tests, empty cylinders with expired test periods should be returned to the nearest naval supply point or cylinder testing activity marked "for retest."

Repairs

Cylinders are repaired only by activities specifically authorized to perform such work. To assure that all cylinders aboard ship are in satisfactory and serviceable condition, periodic inspections should be made. Defective cylinders should be relieved of pressure and turned in to the nearest supply point in exchange for other cylinders.

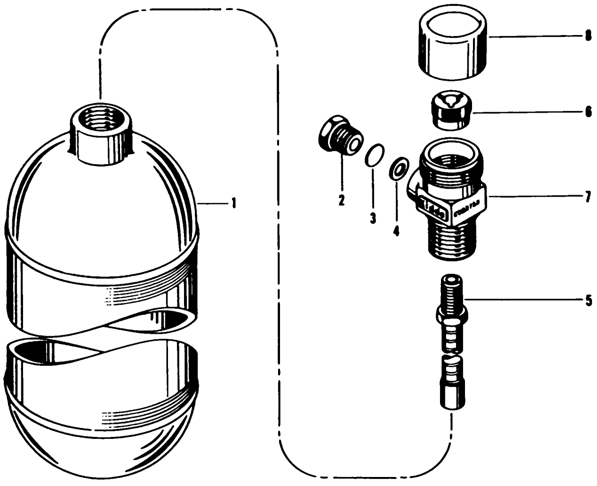
The following marks or defects require a cylinder to be turned in for repair:

1. Severely dented, gouged, or corroded.
2. Bulges (deformation from internal pressure).
3. Damaged, split, or leaky seams.



1. Wire seal, copper and lead.
2. Cover.
3. Screw.
4. Washer.
5. Cable.
6. Ball and cable assembly.
7. Half-ball.
8. Screw.
9. Brass hex nut.
10. Cable.
11. Cable housing.
12. Nonrecoil outlet.
13. Retainer.
14. Spring.
15. Cutter.
16. Washer.
17. Swivel plug.
18. Stud.
19. Screw.
20. External teeth ty lockwasher.
21. Sheave and cam.
22. Discharge head bo

Figure 16-9.—Discharge head assemblies employing cutter type action.



1. Cylinder (number 1 in the figure represents five sizes, each one capable of containing a specified CO_2 charge as follows: 1.80 lb, 2.05 lb, 3.25 lb, 4.70 lb, and 9.40 lb. When the 3.25-lb size cylinder is winterized with nitrogen, it contains a lesser charge—2.98 lb, and when the 4.70-lb size cylinder is winterized, it contains 4.32 lb).
2. Safety disc retainer.
3. Safety disc (two different capacities).
4. Safety disc washer.
5. Syphon tube (four different sizes).
6. Disc bushing, red or black, depending on capacity.
7. Body (three different sizes).
8. Shipping cap.

Figure 16-10.—Cylinder and disc body assemblies adaptable to bushing discs and cutter type discharge heads.

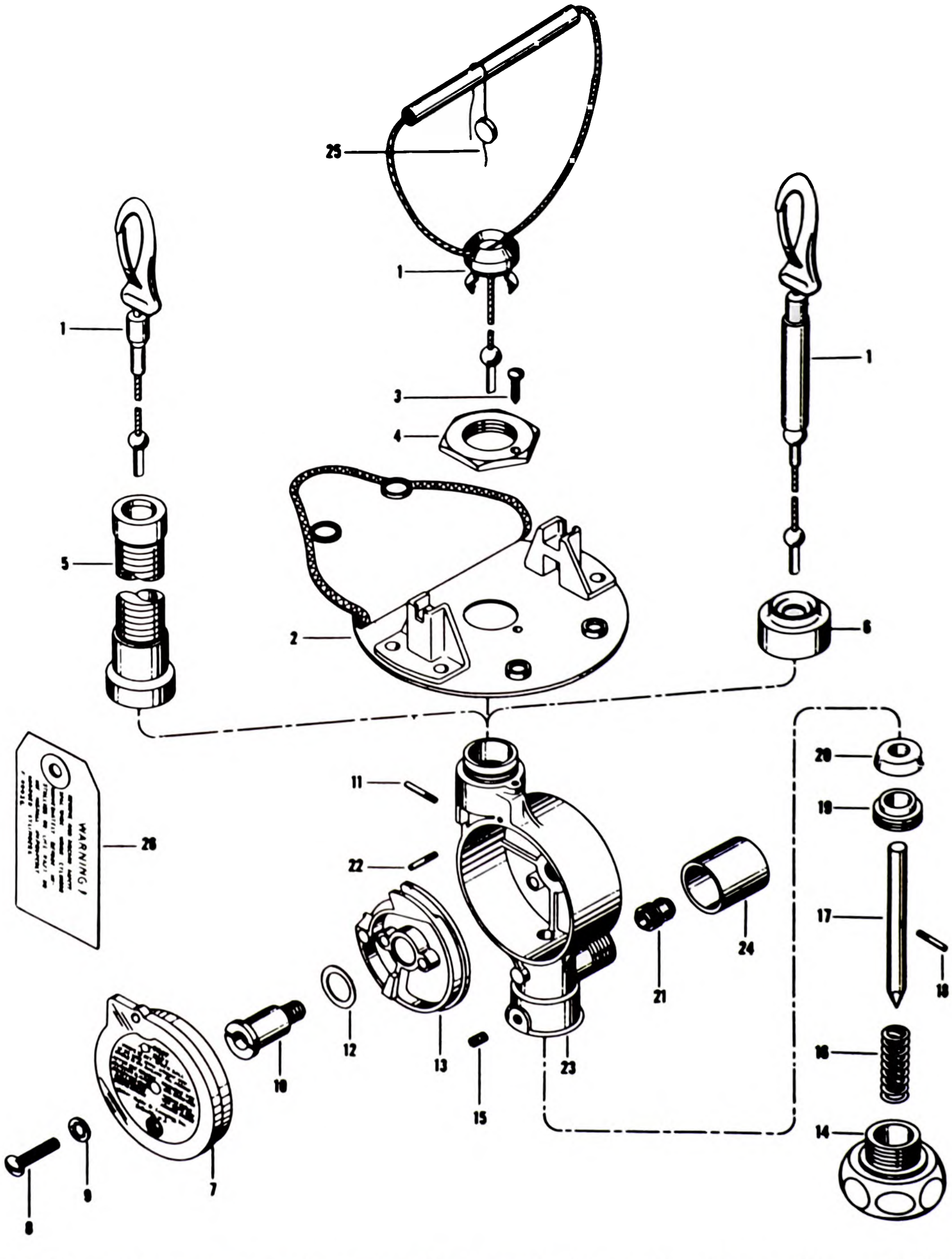


Figure 16-11.—Discharge head assemblies employing cutter type action with hand and remote pull cables.

Nomenclature for figure 16-11.

ll cables.
ard flap and plate.
rew.
llar.
ble housing.
ble outlet cap.
meplate cover.
rew.
9. Washer.
10. Stud.
11. Pin.
12. Shim.
13. Cam pulley.
14. Bottom cap.
15. Screw.
16. Spring.
17. Disc cutter.
18. Pin.
19. Packing retainer.
20. U-cup hydraulic packing.
21. Recoil adapter.
22. Pin.
23. Body.
24. Protection cap.
25. Wire seal.
26. Tag.

NOTE: Pull cables (1) are adaptable to remote control systems. The use of one or the other is dependent on its adaptability to a specific aircraft in relation to its liferaft inflation system.

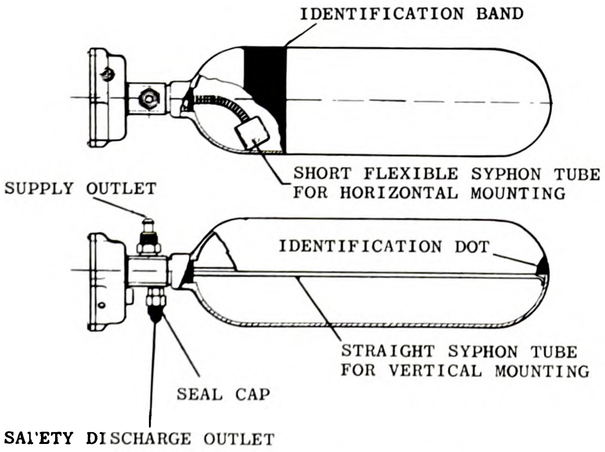

IDENTIFICATION BAND
SHORT FLEXIBLE SYPHON TUBE FOR HORIZONTAL MOUNTING
SUPPLY OUTLET
IDENTIFICATION DOT
STRAIGHT SYPHON TUBE FOR VERTICAL MOUNTING
SEAL CAP
SAFETY DISCHARGE OUTLET

Figure 16-12.—Syphon tubes.

CHAPTER 17

SAFETY BELTS AND SHOULDER HARNESSES

If an award could be given to an item of equipment for the most successful record of saving lives, as well as preserving them, the safety harness (belt and shoulder straps) would take it. Actually, no award would be adequate from a repayment standpoint, as this "famous pair" is forever on the job working to keep airmen in their seats. Keeping a pilot in his seat, away from the danger of falling out or bumping against the interior of a cabin, is a full-time problem, and one that has been met with great success.

When wearing a safety harness, pilots can survive many craches in which the cockpit or cabin remains reasonably intact, and the harness will also hold the pilot in the seat during ejection. The pilot is held in the seat while being ejected from the aircraft and then is automatically released from the seat after ejection.

What the harness team must offer can be condensed into one statement: The lap belt and shoulder harness combination must be strong enough to hold a man in his seat under all reasonable stress conditions that might be experienced in high-speed flight, seat ejections, arrested landings, ditchings, or noseover crashes. It must be designed so that it can be released quickly.

Testing and inspecting of safety belts and shoulder harnesses are responsibilities of the Parachute Rigger.

PILOT'S LAP BELT AND SHOULDER HARNESS

Pilot's safety belts may be furnished as complete assemblies, consisting of lap and shoulder straps, or as individual components. There are several types of lap belts and shoulder harnesses. Figure 17-1 illustrates a complete assembly of one type.

CONVENTIONAL LAP BELT

Figure 17-2 illustrates the pilot's conve tional lap belt (MS 22033) showing its stitchi pattern, parts assembly, and other significa physical characteristics.

The lap belt is designed to take an ULT MATE LOAD OF 9,000 POUNDS without failu in the webbing, fittings, or stitched joints; ho ever, a deformation under this maximum lo does not constitute a rejection of the man factured lot. Also, during manufacture, bel are subjected to 6,000 POUND PROOF TEST After this test, no excessive deformation the parts or stitching is permitted in the a sembly. The latch must work freely when t load is released.

The ultimate load and proof load requir ments applied to a lap belt immediately aft its manufacture (at the plant) should not confused with the periodic service tests giv this equipment in the field. Field test loa do not even approach the tensile streng capacity of the assembled belt.

All major stiching is done with 6-cord nyl thread, size E being used in the less importa tensile strength areas.

LAP BELT (AUTOMATIC-RELEASE TYPE)

Safety belts installed in aircraft with ejecti seats in accordance with installation MS 160 have an automatic-release feature incorporate Its function is to hold the pilot in the seat duri ejection, then open automatically and arm t parachute actuator after the pilot and seat a clear of the aircraft. This feature is design to eliminate the necessity of the pilot releasi his safety belt at exactly the proper time a pulling his own ripcord, thus making ejecti from an aircraft a much simpler and safer tas

The automatic-release type safety belt cartridge operated. The complete assemb

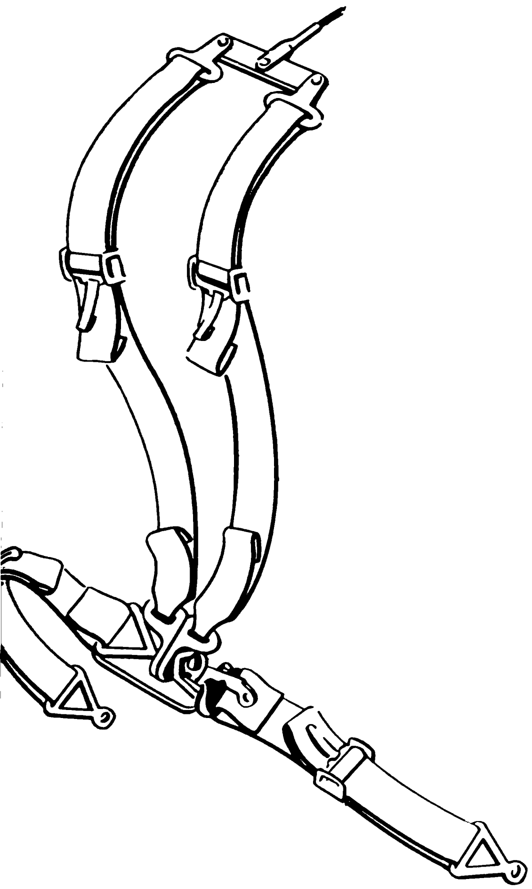


Figure 17-1.—Pilot's lap belt and shoulder harness.

ists of the two belt halves, link latch, cable mbly, actuator assembly, and actuating assembly, as shown in figure 17-3.

Vhen an automatic parachute actuator is l, the cable to the actuator is attached to belt as shown in figure 17-3. When the belt utomatically separated and the pilot leaves seat, the parachute actuator arming link is rained by shoulders on the belt adapter , pulling the cable and arming the actuator. Piston action in the actuator assembly pulls cable which is secured to a link holding the ty belt, shoulder harness and parachute ing wire together. If the automatic release s to operate, the belt and shoulder harness be released manually in the normal manner the pilot must pull his own ripcord.

During normal use, the belt halves are ually joined and separated to attach or free the parachute actuator link so that the parachute can be removed from the seat without danger of actuating the automatic actuator.

SHOULDER HARNESS

Figure 17-4 illustrates the H-type shoulder harness' dimensions, its stitching pattern, how it is put together, its parts, and other significant physical characteristics. The Y- and V-types are shown in figures 17-5 and 17-6. Where the lap belt remains fairly standard in its attachment to the pilot's seat, the shoulder harness must quite often be modified to fit its anchored location. This subject will be discussed under installation.

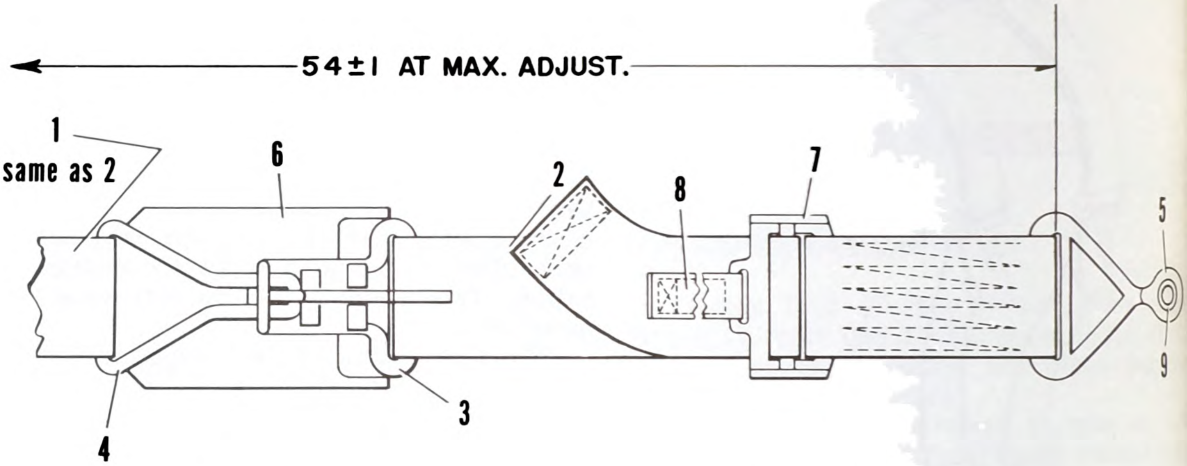
The anchor plate of the Y-type is adjustable, making it possible to lengthen or shorten the leg of the harness for a particular aircraft installation. The length of the leg of the Y must be adjusted so that there is adequate shoulder harness adjustment available, yet the crotch of the Y is not on the pilot's neck. During the manufacture and before acceptance, shoulder straps are subjected to a 3,500-pound ultimate load. A reasonable deformation of the parts is permissible.

A proof load of 3,000 pounds is also made and the straps must not have slipped appreciably through the adjustment loops. No noticeable deformation of any kind is permitted in this test. The proof test, then, establishes the highest tensile strength load a shoulder harness will withstand and still operate satisfactorily afterwards. The ultimate test is designed to stop at a tensile strength value just short of complete destruction. With reasonable care and by applying preventive measures, the shoulder harness will give long and honored service, easily passing its field test loads. The latest straps are made of Dacron, a "miracle fiber" similar to nylon. Dacron has less stretch than nylon.

NOTE: One assembly out of every 1,000 submitted for acceptance must be subjected to the ultimate load, and any safety belts or shoulder harness subjected to the ultimate load must not be shipped under contract.

INERTIA REEL

The inertia reel is installed on the back of all crewmembers' seats for attachment of the shoulder harness. Its purpose is to allow free movement of the crewmember when in the unlocked position and prevent any forward movement when in the locked position.



1. Right side of belt (3-inch nylon webbing).
2. Left side of belt (3-inch nylon webbing).
3. Latch assembly.
4. Link.
5. Loop.
6. Leather protector.
7. Adjuster.
8. Pull tab.
9. Bushing.

Figure 17-2.—Pilot's lap belt (conventional type).

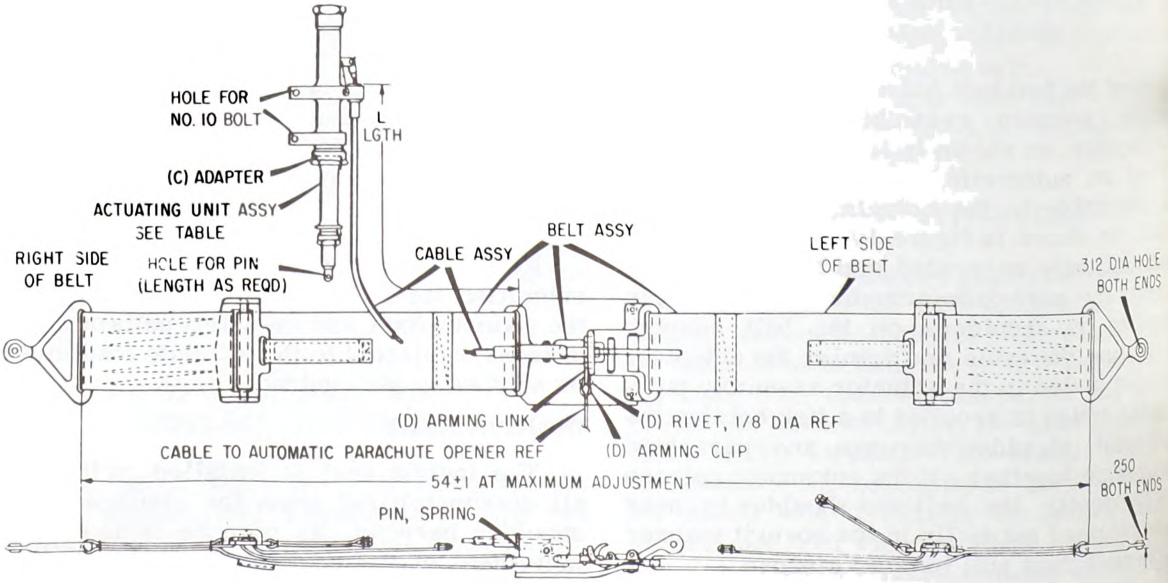
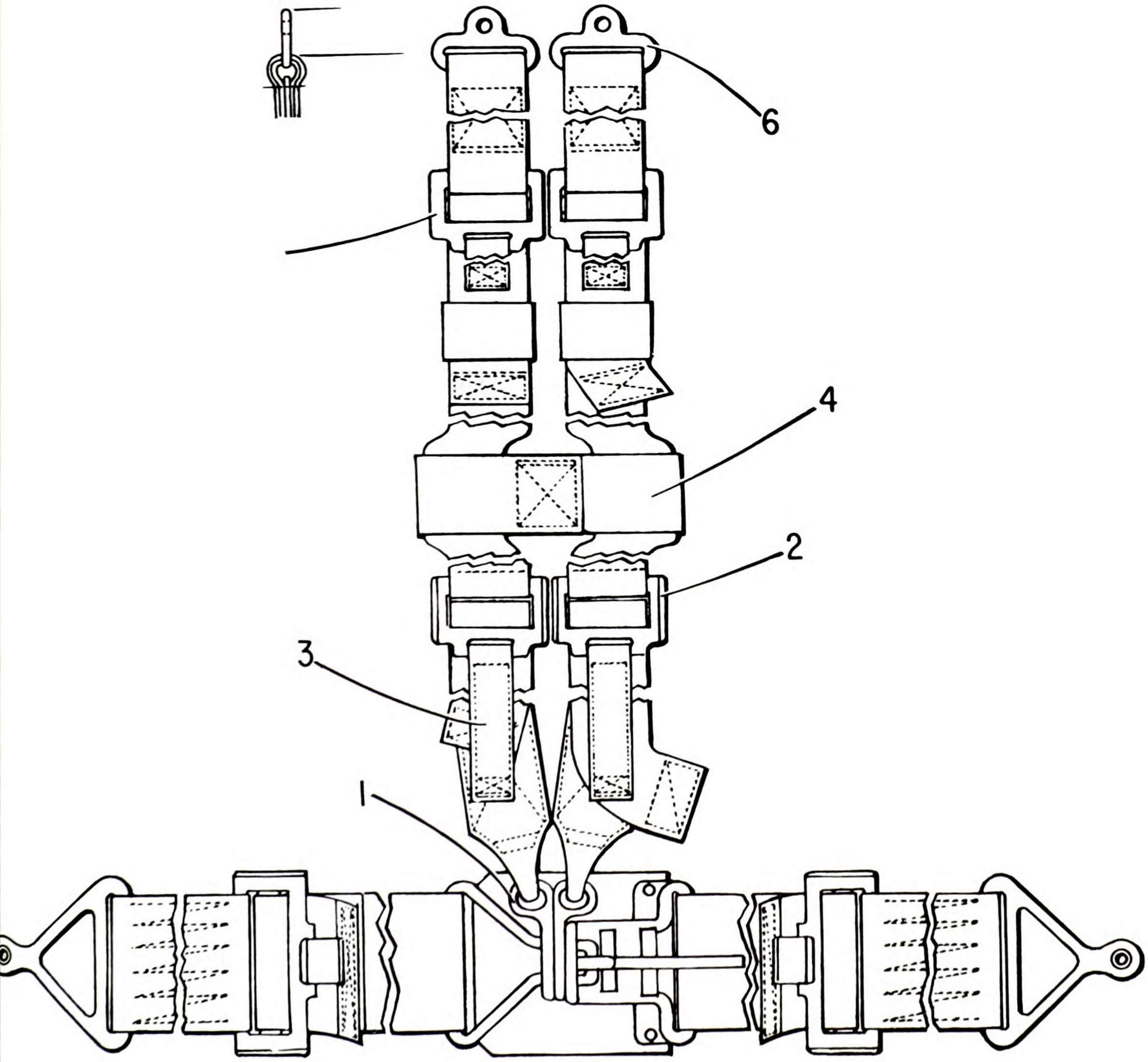


Figure 17-3.—Lap belt, automatic-release type.



1. Link (left and right).
2. Adjuster.
3. Pull tab.
4. Keeper.
5. Adjuster.
6. Plate attachment.

Figure 17-4.—Shoulder harness with separating keeper.

The inertia reel must be locked during take- landing, and aerobatics. A force of 2 to 3 will lock the reel automatically, depending the type of reel and direction of the load. directional reels lock only with g loads lied in a narrow cone along the aircraft's s. Multidirectional reels lock in almost all ections of applied g loads. The reel pays out 18 inches if in the unlocked position, the position for normal flight.

Figure 17-7 illustrates a currently used electromagnetic inertia reel. With electrical power off, this reel will be locked when the control handle is in either of its end positions. The reel may be released by moving the handle to its middle position.

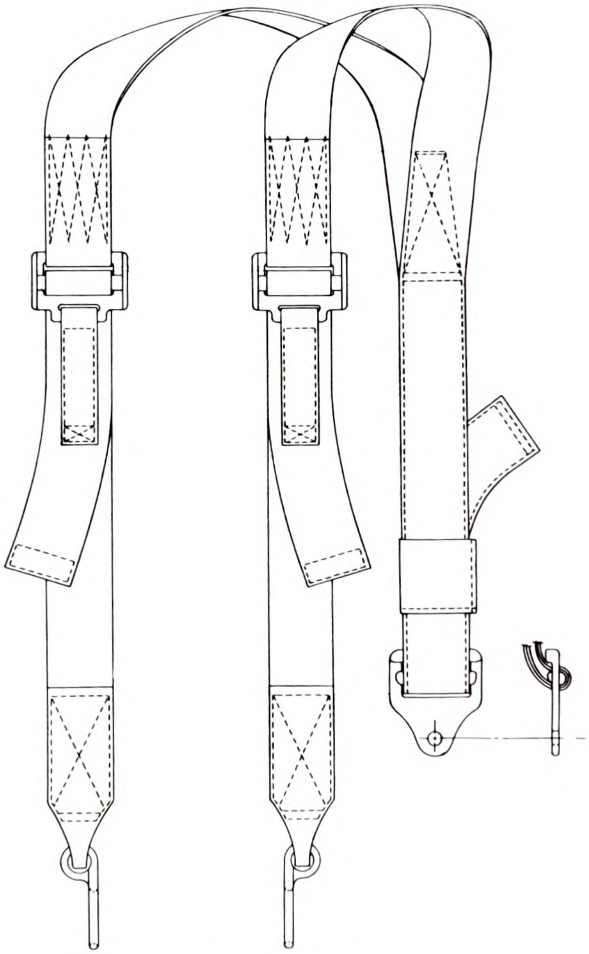


Figure 17-5.—Pilot's shoulder harness—Y-type.

Although inertia reel maintenance is not one of the PR's qualifications, information is given here, since it falls within the scope of general knowledge considered useful to the PR.

MISCELLANEOUS SAFETY BELTS

CREWMAN'S BELT

The crewman's safety belt is designed to permit a reasonable amount of movement of the wearer in performing his duties while holding him securely in the aircraft. Figure 17-8 illustrates the MS 16070 belt. An aerial cameraman would use one of these when shooting oblique assignments out of open hatches. The tail str which is adjustable (22 inches to 65 inche approximately) can be anchored to any stro part of the aircraft's structure which is adaptal to its hook. Normally the smaller the amo of tail strap payed out, the less will be danger of being whipped about when the aircr is maneuvered violently.

As the crewman makes the attachment, should anchor to a strong structural mem making certain that the attachment will not m or damage equipment.

GUNNER'S BELT

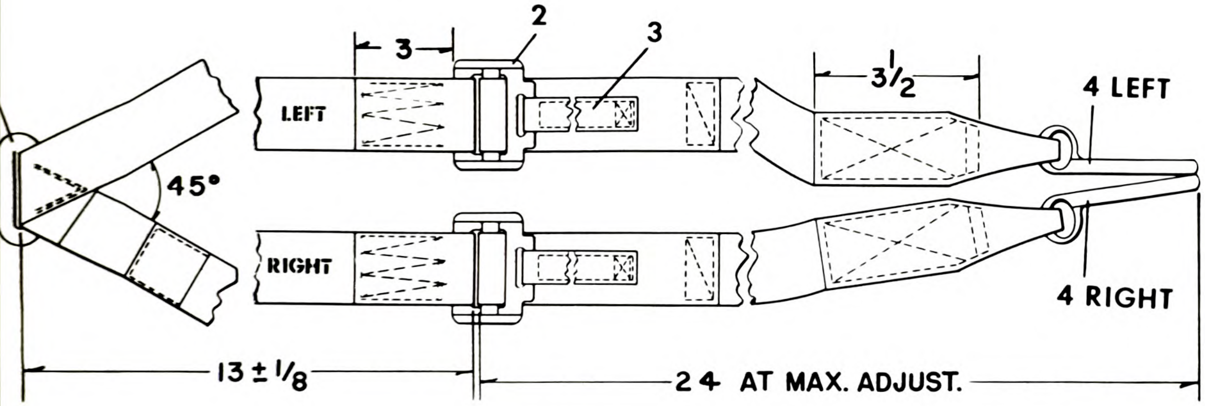
The gunner's belt side straps permit mo movement than the pilot's type (which is desig primarily to hold him solidly in his seat). T length of the gunner's belt side straps is adju able, thereby permitting the wearer security standing as well as in sitting. (See fig. 17-

TROOP AND PASSENGER BELTS

Passenger belts are not used widely in na aviation. They are installed in certain util and transport aircraft and in some patrol typ The AN6506 troop belt is more generally spe fied for combatant type aircraft. Both types belts have the quick-release feature. The tro belt is designed for an ultimate load of 5,0 pounds while the passenger type is designed hold up under a load of 4,500 pounds. The we bing of troop and passenger belts is narrow than the pilot's belt, being approximately inches. The AN6506 belt has the same ty latching as the pilot's belt; however, the pa senger type belt may vary with manufacturer All major stiching is accomplished with 3-co nylon thread. Figure 17-10 shows the troop be while the passenger type belt and its applicati are shown in figure 17-11.

INSPECTIONS AND TESTS

Personnel of the AME rating are normal responsible for routine inspection of safe belts, shoulder harness, and inertia reels, a PR's are responsible for performing proof lo tests. However, Parachute Riggers should familiar with inspection procedures as well testing procedures.



(B)

1. Anchor plate.
2. Adjuster.
3. Tab.
4. Links (left and right).

Figure 17-6.—Pilot's shoulder harness—V-type.

LY INSPECTION

afety belts and shoulder harnesses are in-
ted daily for obvious signs of wear or de-
oration of the metal parts and for wear or
ing of the webbing. Release buckles, snap-
s, and other operating parts must be checked
proper functioning.

CRAFT CALENDAR INSPECTION

Make a complete and thorough inspection of
equipment as for the daily inspection and
ude a close examination for corrosion,
cks, wear, fraying, rot, broken stitches or
in the webbing, cable or other parts.

Inspect all parts of the aircraft that the lap
s, shoulder harness, or inertia reel webbings
contact for any deformation such as sharp,
ged edges or roughness which may cause
ing or excessive abrasion.

Note the date of proof load testing of af-
ted components. All components are to be
of load tested in accordance with Air Crew
tems Bulletin #2 to insure that the prescribed
intervals are not exceeded before the next
endar inspection.

Correct all discrepancies by local repair,
dification, or by replacing components. If a discrepancy is found to be due to aircraft, seat, or restraint system design, submit an AMPFUR describing in detail the defect.

PAR/OVERHAUL INSPECTION

During aircraft PAR or overhaul, remove lap belts, shoulder harness and inertia reel, and takeup reel webbings. Conduct a thorough visual inspection as for aircraft calendar inspection. Perform proof load tests of all components and replace all cotton with nylon or dacron.

Test/Replacement Intervals

Lap belts, shoulder harness, and inertia reel webbings are to be proof load tested prior to installation and at intervals not to exceed the following:

Safety belts and straps which are made of cotton are removed from the aircraft, inspected thoroughly, and proof load tested every 6 months, then replaced with equipment made of nylon or dacron at the next PAR.

Safety belts and straps which are made of synthetic materials (nylon or dacron) are proof load tested every 18 months.

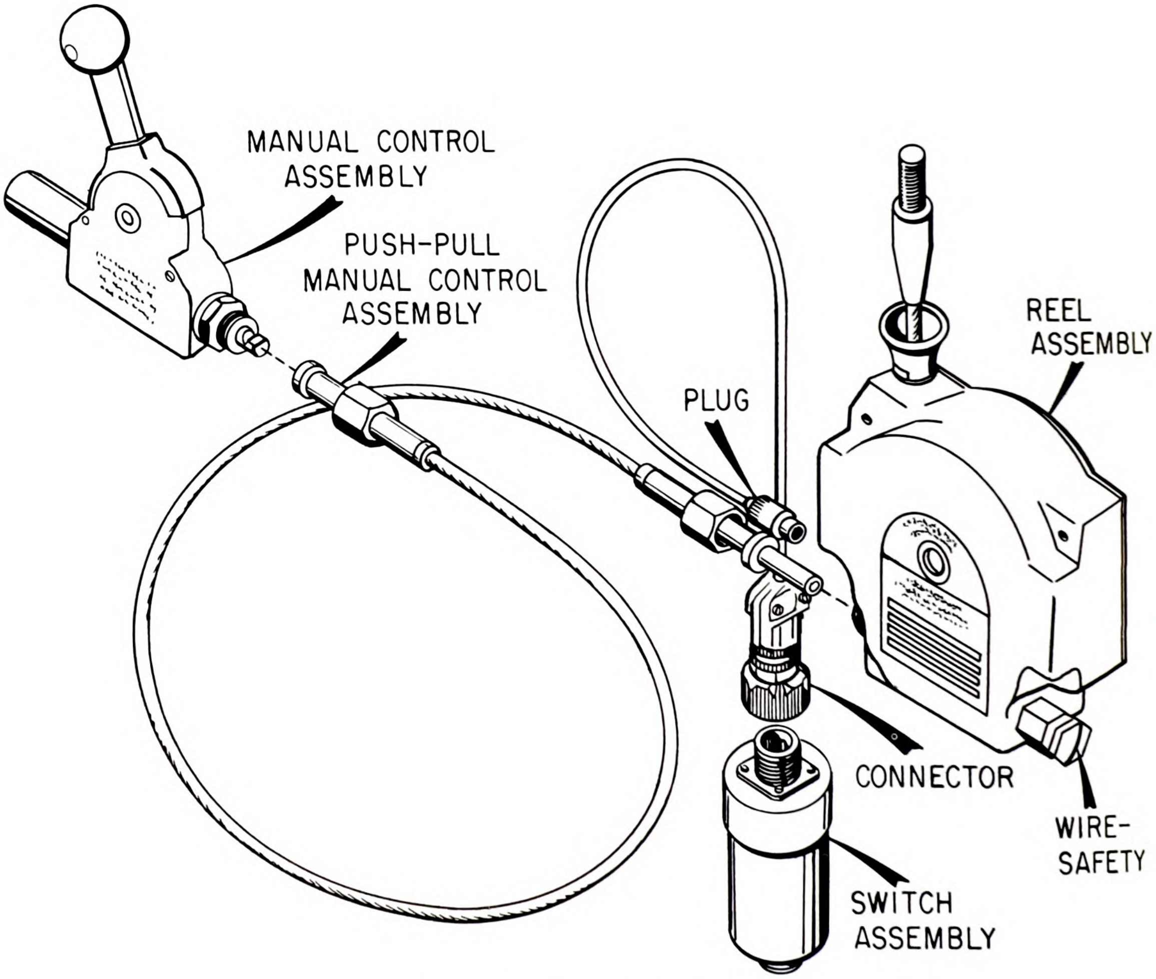


Figure 17-7.—Inertia reel.

Proof Load Testing

Proof load testing is to be performed by class C maintenance activities and above. When components require proof load testing at other activities, they must be removed and sent to the nearest authorized activity with the capability to make the tests.

Test loads to be applied are listed in Air Crew System Bulletin #2.

Test equipment is to be recalibrated at intervals not to exceed 6 months.

V- and Y-type loads must be held for 30 seconds, and all others for 60 seconds. After application of the specified loads, there can be no signs of weakening or failure in the metal parts, webbing, or stitching. There must be perceptible slippage of the webbing through t adjustment loops, and the lap belt release mu work freely. The quick release buckle of the la belt must be operable under a pull of not ove 45 POUNDS ON THE LATCH WHILE THE BEL IS SUBJECTED TO A STATIC LOAD OF 40 POUNDS.

BELT TESTING EQUIPMENT

Any one of several methods may be used fo applying the prescribed proof load to the belt and straps; for example, mechanical tensio testers, tripod lifts, deadweight loading, an others. The accuracy of the actual reading i

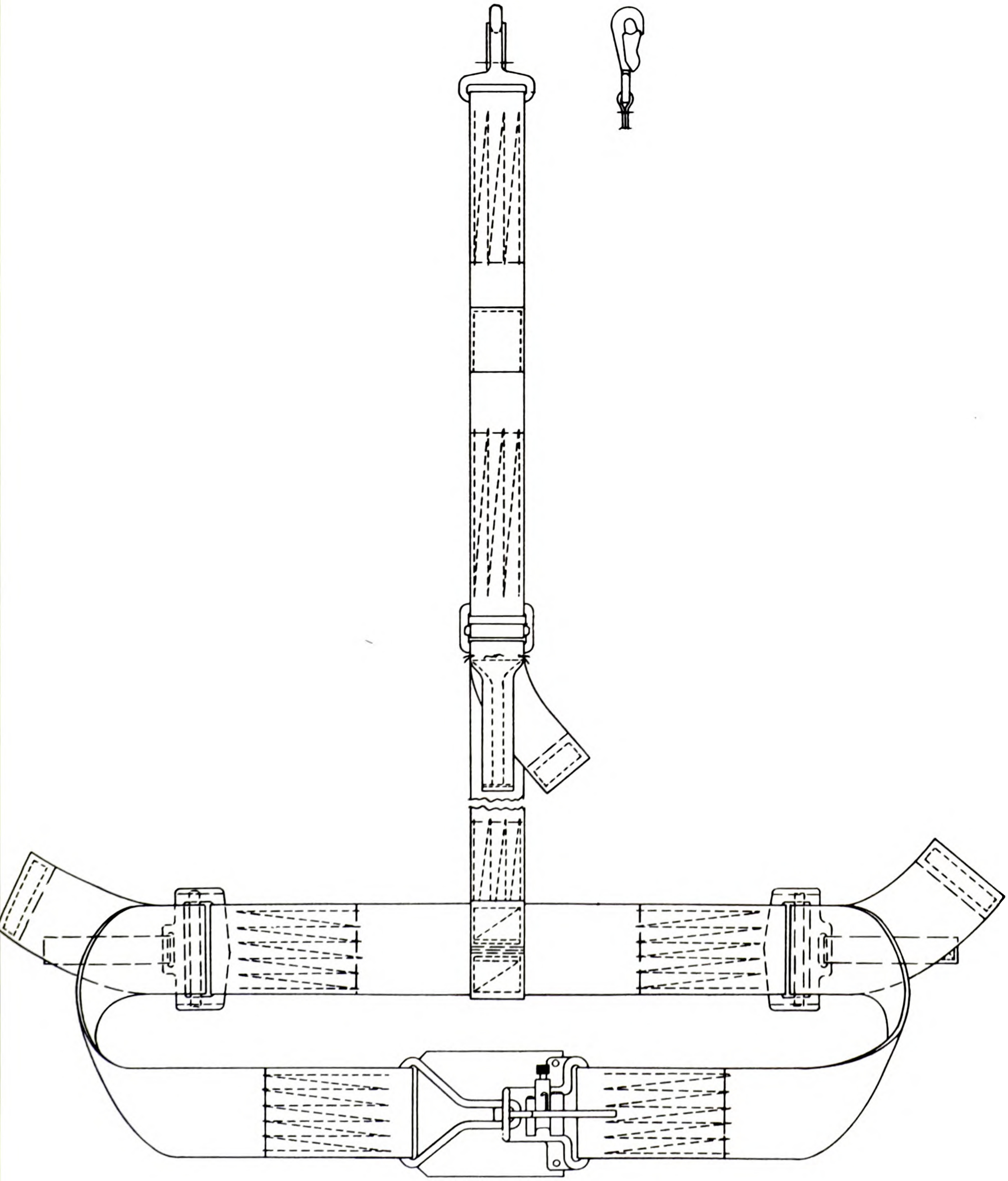


Figure 17-8.—Crewman's safety belt.

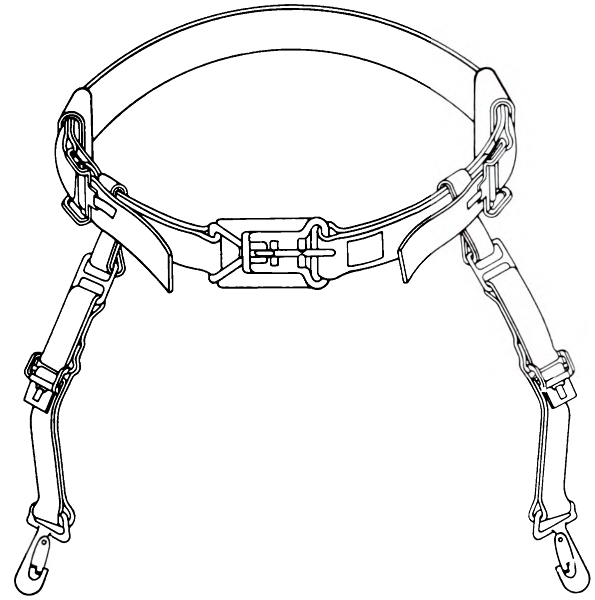


Figure 17-9.—Gunner's safety belt.

more important than the manner in which the test load is applied.

A testing jig made from salvaged material is shown in figure 17-12. Its capacity is approximately 5,000 psi, a necessary reserve in power. The device can be mounted horizontally or vertically depending on the dictates of the physical plant. The movable head and the stationary head should be mounted far enough apart so that all lengths of belts and harnesses together with their necessary mounting clamps or adapters can be accommodated. In many cas these have to be manufactured locally. Any Par chute Rigger can design the special jig necessa to do the job. For example, the part used in aircraft to hold the mounting plate of a shoul harness can be rigged to a testing jig and be us for the same purpose during test.

The device shown in figure 17-12 is adequa Its construction details need not be follow closely. As a precaution, a wire cage must constructed and placed over the area that l between the two attachment heads. Then operator will be guarded against the possibilit of sudden breakage and the accompanying whi ping action that takes place.

Calibration

After construction of a testing device, it w be necessary to recalibrate the pressure ga from psi to pounds. This will insure an eas read value in relation to the specified tens load. Calibration can be done by any of methods suggested below. The load in poun (50-pound increments) can be marked direc on the gage dial, or a chart may be prepa to indicate the equivalent load in pounds for corresponding psi graduations.

1. DEADLOAD. Secure the actuating cy inder in an upright position with the piston downward. Record the pressure (psi) requi to lift deadloads of known weights.

2. SPRING. Place a large capacity spr scale of known accuracy between the two ja of the test device and apply pressure. Rec the loads in pounds shown on the scale vers the pressure in psi indicated by the gage.

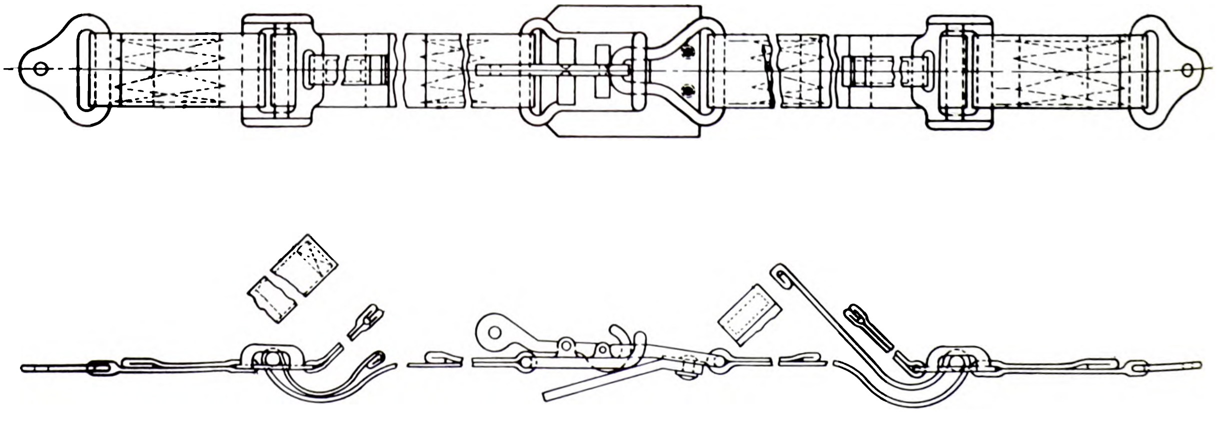
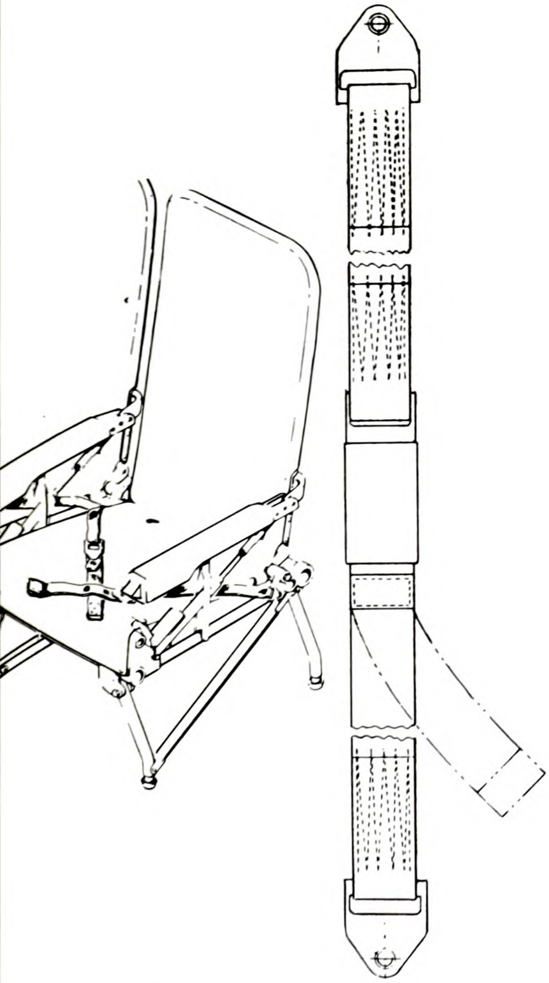


Figure 17-10.—Troop type safety belt.



igure 17-11.—Passenger type safety belt.

3. DYNAMOMETER. Place a loop or Chatillon dynamometer of approximately 5,000 pounds capacity between the two jaws of the testing device and apply pressure. Record the load in pounds against the psi indicated by the gage.

Operation

The device requires only one man to operate it. Secure one end of the belt or shoulder strap to the ratchet rod and the other end to the piston rod. The length of the adjustable ratchet and the piston rod will afford sufficient clearance for testing belts of various lengths. Turn the selector valve handle to the loading position. Apply the required load by operating the hand pump. Read the load on the calibrated gage. Hold for 30 seconds or 1 minute, as specified for the particular harness, and release the load by turning the selector valve handle to an unloading position.

Recalibrate the gage every 6 months; breakages in the system should be repaired as they occur. Replenish the oil supply when needed.

Safety belts and shoulder harnesses found to be damaged or unable to withstand the strains of testing should be replaced with the latest equipment.

Figure 17-13 illustrates the application of a testing jig to the harness. The jig is adaptable to Y- and V-type shoulder harnesses, also the H-type. The anchoring adapter shown in figure 17-13 is not made in accordance with a specified drawing. However, the important thing to consider is its adaptability to the type belt or strap arrangement being tested. As long as an anchoring adapter does not produce any twists or undue strain on the article under test, it may be considered adequate.

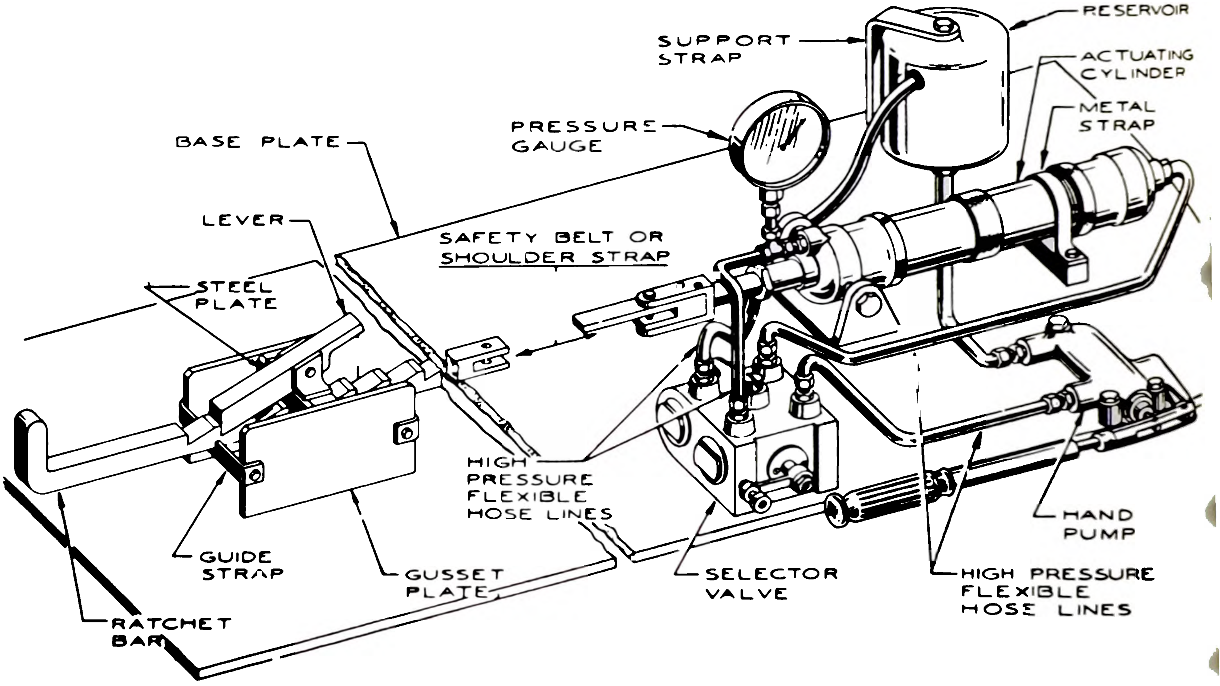


Figure 17-12.—Safety belt and shoulder harness testing jig.

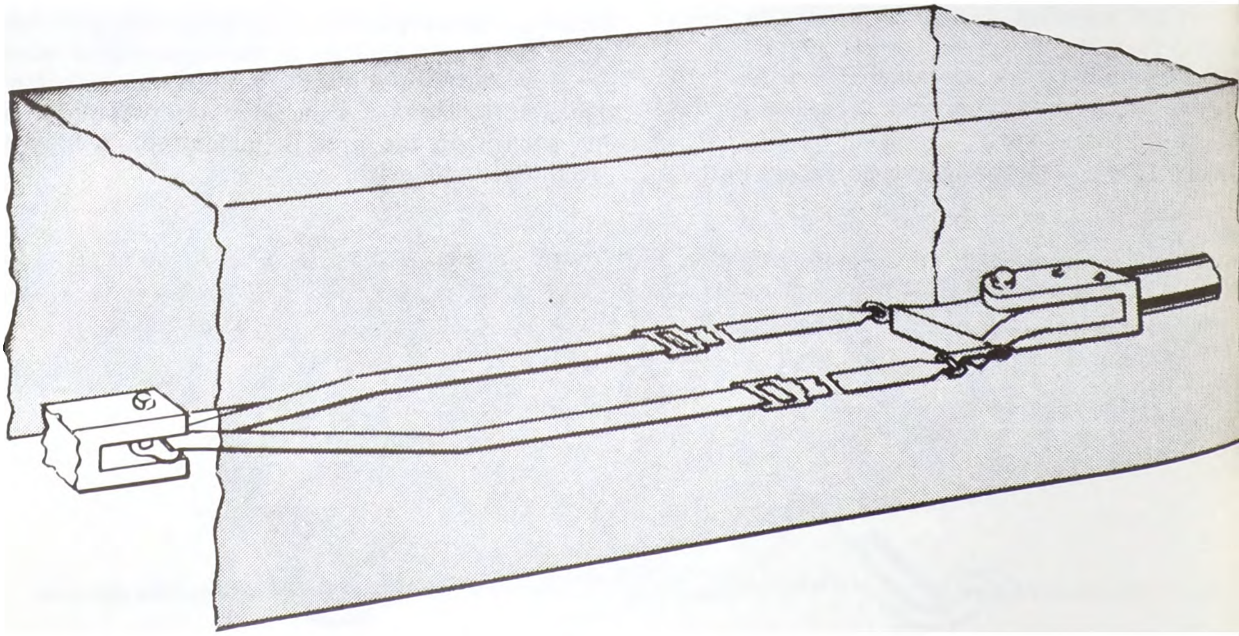


Figure 17-13.—Application of jig to shoulder harness.

APPENDIX I

FILM LIST

8379 "G" Facts. (23 minutes.) Explains asic principles of gravitational pull, and overs the physical effect on the human ody with a description of positive "G," egative "G," and transverse "G." The use nd purpose of different types of anti-g uits are explained. Applicable to chapter 14.

-7458B Aviation Exposure Suit Mk 4. (16 ninutes.) Shows fitting, maintaining, and vearing of the Mk IV exposure suit. Applicable o chapter 14.

-9384 Operation of the 97-10 Sewing Machine. 16 minutes.) Discusses operation and care, nd identifies component parts of the 97-10 sewing machine. Applicable to chapter 10.

MN-6915A High Altitude, High Speed Flight Problems—Physiological Effects. (23 minutes.) Explains operation of oxygen equipment, cabin pressurization and ventilation, g-suits, and escape methods. Applicable to chapters 13 and 14.

MA-6920 Uses of Oxygen in Aviation. (22 minutes.) Shows uses and effects of oxygen at high altitudes, effects oxygen has on the human body, etc. Applicable to chapter 13.

MN-8323A Full Pressure Suit—Mk IV. (19 minutes.) Describes donning, adjusting, and doffing of the full pressure suit. Explains operation of the suit at various altitudes. Applicable to chapter 14.

APPENDIX II

REDESIGNATION OF NAVAL AIRCRAFT

ATTACK SERIES

Current designation	Former designation
A-1E	AD-5
EA-1E	AD-5W
EA-1F	AD-5Q
A-1H	AD-6
A-1J	AD-7
A-3A	A3D-1
EA-3A	A3D-1Q
A-3B	A3D-2
EA-3B	A3D-2Q
RA-3B	A3D-2P
TA-3B	A3D-2T
A-4A	A4D-1
A-4B	A4D-2
A-4C	A4D-2N
A-4E	A4D-5
A-5A	A3J-1
A-5B	A3J-2
A-5C	A3J-3
A-6A	A2F-1
EA-6A	A2F-1H

NOTE: Future New Attack Aircraft will be designated starting at Design No. -7A.

BOMBER SERIES

Current designation	Former designation
UB-26J	JD-1
DB-26J	JD-1D

NOTE: Future New Bomber Aircraft will be designated starting at Design No. 1A

HELICOPTER SERIES

Current designation	Former designation
UH-1E	HU-1E
UH-2A	HU2K-1
UH-2B	HU2K-1U
SH-3A	HSS-2
VH-3A	HSS-2Z
TH-13L	HTL-4
TH-13M	HTL-6
TH-13N	HTL-7
UH-13P	HUL-1
UH-13R	HUL-1M
CH-19E	HRS-3
UH-19F	HO4S-3
UH-25B	HUP-2
UH-25C	HUP-3
LH-34D	HYS-1L
SH-34G	HSS-1
UH-34D	HUS-1
VH-34D	HUS-1Z
UH-34E	HUS-1A
SH-34H	HSS-1F
SH-34J	HSS-1N
CH-37C	HR2S-1
UH-43C	HUK-1
OH-43D	HOK-1
CH-46A	HRB-1
QH-50A	DSN-1
QH-50B	DSN-2
QH-50C	DSN-3
XH-51A	NEW

NOTE: Future New Helicopters will be designated starting at Design No. -52A.

ANTI-SUB SERIES

Current designation	Former designation
S-2A	S2F-1
TS-2A	S2F-1T
S-2B	S2F-1S
S-2C	S2F-2
RS-2C	S2F-2P
S-2D	S2F-3
S-2E	S2F-3S

NOTE: Next design No. for Anti-Sub is No. -3A.

TRAINER SERIES

Current designation	Former designati
T-1A	T2V-1
T-2A	T2J-1
T-2B	T2J-2
T-28A	T-28A
T-28B	T-28B
DT-28B	T-28BD
T-28C	T-28C
T-33B	TV-2
DT-33B	TV-2D
DT-33C	TV-2KD
T-34B	T-34B
T-39D	T3J-1

NOTE: Next New Train design will start at N -41A.

UTILITY SERIES

Current designation	Former designati
U-1B	UC-1
U-6A	L-20A
U-11A	UO-1
HU-16C	UF-1
TU-16C	UF-1T
HU-16D	UF-2

NOTE: Utility series wi continue with Design N -17A.

OBSERVATION SERIE

Current designation	Former designati
O-1B	OE-1
O-1C	OE-2

NOTE: Future New Obse vation Aircraft will be de ignated starting at Des No. -2A.

rent nation	Former designation
PATROL SERIES	
)	P2V-4
E	P2V-5F
2E	P2V-5FD
2E	P2V-5FE
2E	P2V-5FS
F	P2V-6
2F	P2V-6M
2F	P2V-6T
G	P2V-6F
H	P2V-7
2H	P2V-7S
2J	P2V-7LP
A	P3V-1
4B	P4Y-2K
A	P5M-1
5A	P5M-1S
5A	P5M-1T
B	P5M-2
5B	P5M-2S

E: Next design No. will
7A.

ARGO/TRANSPORT SERIES

-45J	SNB-5P
-45J	SNB-5
47H	R4D-5
-47H	R4D-5Q
-47H	R4D-5L
-47H	R4D-5S
-47H	R4D-5R
-47H	R4D-5Z
47J	R4D-6
-47J	R4D-6Q
-47J	R4D-6L
-47J	R4D-6S
-47J	R4D-6R
-47J	R4D-6Z
-47K	R4D-7
-54N	R5D-1Z
54P	R5D-2
-54P	R5D-2Z
54Q	R5D-3
-54Q	R5D-3Z

Current designation	Former designation
C-54R	R5D-4R
C-54S	R5D-5
VC-54S	R5D-5Z
C-54T	R5D-5R
C-117D	R4D-8
LC-117D	R4D-8L
VC-117D	R4D-8Z
C-118B	R6D-1
VC-118B	R6D-1Z
C-119F	R4Q-2
C-121J	R7V-1
EC-121K	WV-2
WC-121N	WV-3
EC-121L	WV-2E
EC-121M	WV-2Q
TC-117D	R4D-8T
C-130F	GV-1U
KC-130F	GV-1
LC-130F	C-130BL
C-131F	R4Y-1
C-131G	R4Y-2
C-140C	UV-1

Because of the size of the design numbers for Cargo Aircraft, this series will start over at -1A. Following are new assignments made under new series of numbers:

C-1A	TF-1
EC-1A	TF-1Q
C-2A	NEW

NOTE: Future New Cargo/Transport Aircraft will be designated starting at Design No. -3A.

FIGHTER SERIES

F-1C	FJ-3
DF-1C	FJ-3D
MF-1C	FJ-3M
DF-1D	FJ-3D2
F-1E	FJ-4
AF-1E	FJ-4B

Current designation	Former designation
F-2C	F2H-3
F-2D	F2H-4
F-3B	F3H-2
MF-3B	F3H-2M
F-3C	F3H-2N
F-4A	F4H-1F
F-4B	F4H-1
RF-4B	F4H-1P
F-6A	F4D-1
F-8A	F8U-1
DF-8A	F8U-1D
QF-8A	F8U-1KD
RF-8A	F8U-1P
TF-8A	F8U-1T
F-8B	F8U-1E
F-8C	F8U-2
F-8D	F8U-2N
F-8E	F8U-2NE
DF-9E	F9F-5KD
F-9F	F9F-6
DF-9F	F9F-6D
QF-9F	F9F-6K
QF-9G	F9F-6K2
F-9H	F9F-7
F-9J	F9F-8
AF-9J	F9F-8B
TF-9J	F9F-8T
RF-9J	F9F-8P
F-10A	F3D-1
F-10B	F3D-2
EF-10B	F3D-2Q
MF-10B	F3D-2M
TF-10B	F3D-2T2
F-11A	F11F-1

NOTE: Future New Fighter Aircraft will be designated starting at Design No. -12A.

SPECIAL ELECTRONIC INSTALLATION SERIES

E-1B	WF-2
E-2A	W2F-1

NOTE: Future New Special Electronic Installation Aircraft will be designated starting at Design No. -3A.

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